plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

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Plating Tank Drains that Meet Philadelphia Requirements

Philadelphia Branch Fiftieth Anniversary Commemorative and AES Seventh Interim Meeting Program

AES 1960 Annual Convention (Los Angeles) Program

PLATING MAGAZINE

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FEBRUARY - 1

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One of the fastest computing systems ever developed, the UNIVAC Solid-State Computer performs at internal speeds commonly associated with large-scale equipment. Its remarkable speed and storage capacity enable the UNIVAC Solid-State Computer to eliminate much pre-sorting and pre-collating...and combine calculating, reproducing, gang-punching, data-collation, and tabulating in a single run. Each UNIVAC SSC contains over 1,400 printed circuits plated with AUTRONEX ACID GOLD.

REMINGTON RAND USES AUTRONEX* ACID GOLD PROCESS TO PLATE UNIVAC PRINTED CIRCUITS

Remington Rand, Division of Sperry Rand Corporation, Utica, New York, uses the AUTRONEX ACID GOLD PROCESS to plate printed circuit boards for their world-famous UNIVAC Solid-State Computer Systems and Equipment. Installation of the patented AUTRONEX ACID GOLD PLATING PROCESS for this work, "... totally eliminated resist failures and rejects in the electroplating phase," according to a report from Remington Rand's Supervisor of Chemical Engineering.

This report goes on to say that "AUTRONEX ACID GOLD in printed circuit production offers definite advantages and promotes the highest quality production." Here are some of these advantages proved in Remington Rand's own laboratories:

1. Harder and more wear-resistant surfaces.
2. Elimination of one step in plating cycle — no cyanide gold strike required.
3. Promotes higher bond strength of circuit to dielectric base material by minimizing danger of damaging the adhesive layer.
4. Solder flow through plated holes is definitely better, thereby improving over-all quality.
5. AUTRONEX ACID GOLD has totally eliminated circuit lifting and rejects on boards plated after etching. Formulations used previously attacked the adhesive and undermined the circuit paths.

The conclusion of the report we have been quoting needs no further comment: "We would like to commend the manner in which your company has serviced us in regards to materials, equipment and valuable advice. In many instances your promptness in making equipment and materials delivery has been instrumental in meeting vital production target dates."

The patented AUTRONEX ACID GOLD PLATING PROCESS has production-proved its unique advantages for over two years in the plants of leading manufacturers the world over. AUTRONEX can help *you* make a better, more reliable product—probably at far less cost than with any gold plating formulation you may be presently using. Evaluate AUTRONEX ACID GOLD ELECTROPLATE in your own plant, *on your own product*. We'd be happy to plate sample parts for you at no obligation. Write...wire...or 'phone. We'll make all the arrangements.

*Trademark for Sel-Rex patented Acid Gold Plating Process

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PRECIOUS METALS DIVISION

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The world's fastest and most advanced electronic data processing system for business and scientific use, the UNIVAC Larc Solid-State computer, by the Remington Rand Division, Sperry Rand Corporation. The new system, which operates up to 200 times faster than any computer in existence, can perform 250,000 additions and subtractions of 12-digit decimal numbers per second.

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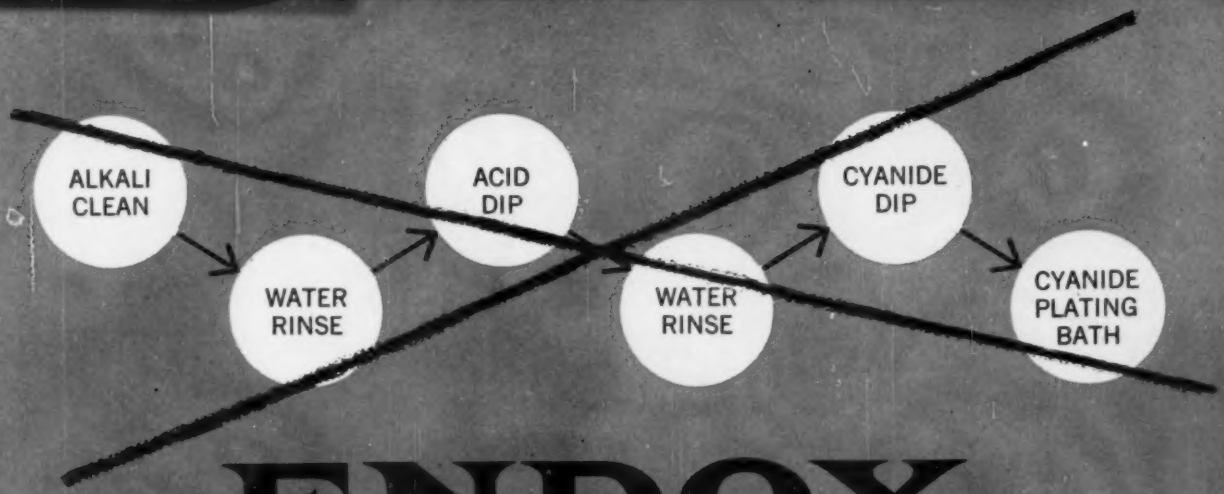

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the PATENTED alkaline deoxidizing process prepares steel for plating in one simple step!

In one, simple electrolytic operation, Endox completely removes rust, scale, smut, soil and oxides from steel and activates it for plating. On work that has been precleaned to remove heavy solid soils, no alkali cleaner, acid dip or cyanide dip are required. Endox replaces them all and gives superior plate adhesion, especially on difficult-to-activate alloy steels. Acid attack and acid fumes are eliminated by use of this room-temperature, alkaline process.

Endox cuts rinse water volume (and rinse water waste treatment costs) way down since there's only one brief rinse in the entire cycle prior to plating in a cyanide plating bath. Endox solutions contain sodium cyanide and are compatible with all cyanide plating solutions.

Endox also produces excellent results prior to acid plating baths. It has solved many problems involving adhesion of nickel plate to malleable iron and alloy steel parts which are later subjected to stress. Prior to acid plating, however, the alkaline Endox residue should be neutralized by a dilute acid dip or "sour rinse".

Endox can be used in both barrel and rack plating lines. Endox solutions are very economical to use because they can be maintained indefinitely by periodic analysis and replenishment, just like a plating bath.

Enthone pioneered alkaline deoxidizing and derusting and first introduced such techniques in 1951. In recognition of this, Patent No. 2,915,444 has been awarded to Enthone. Benefit from our long experience in alkaline pickling; write for literature on Endox and the name of your nearest Enthone representative who will be glad to process sample parts for you. Enthone, Inc., 442 Elm Street, New Haven, Connecticut.

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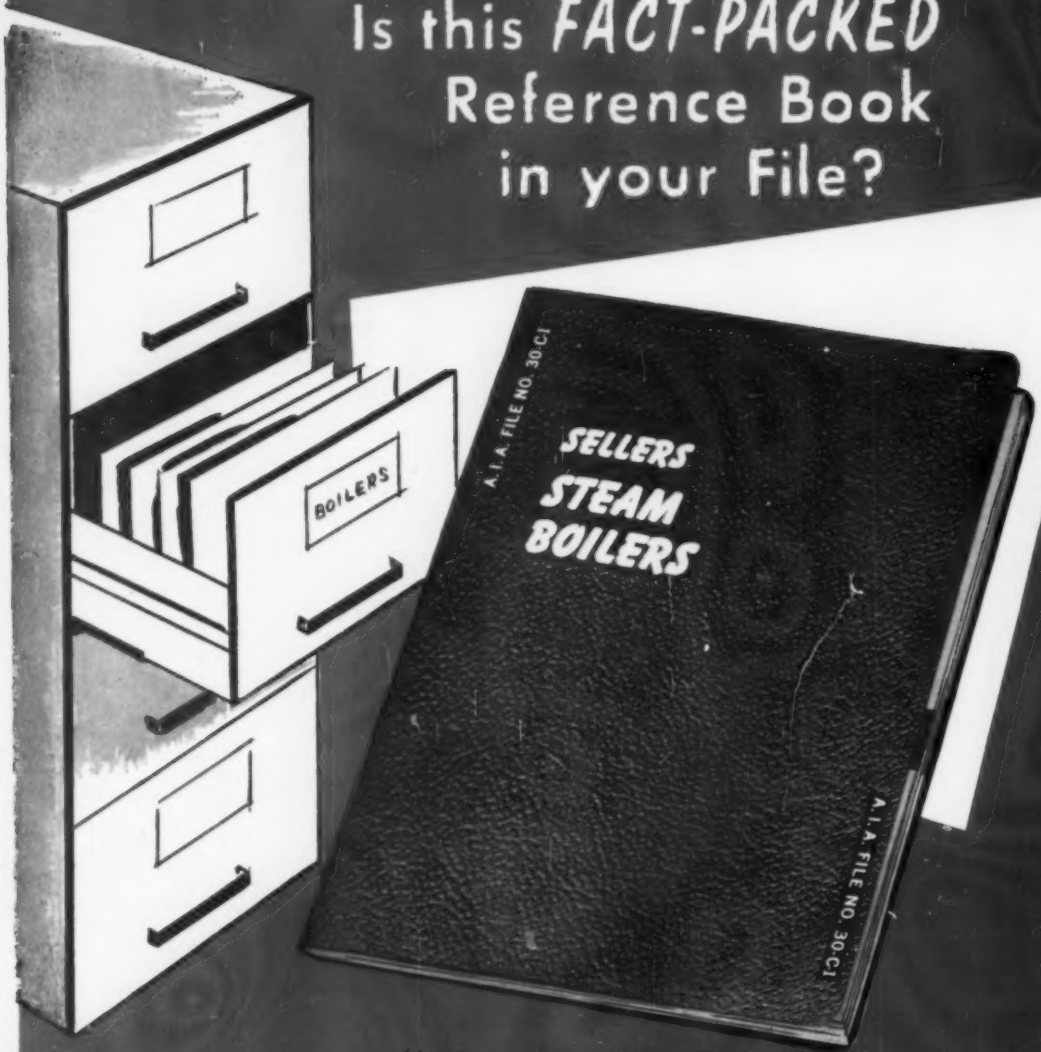

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FEBRUARY 1960 — **Vol. 47, No. 2**

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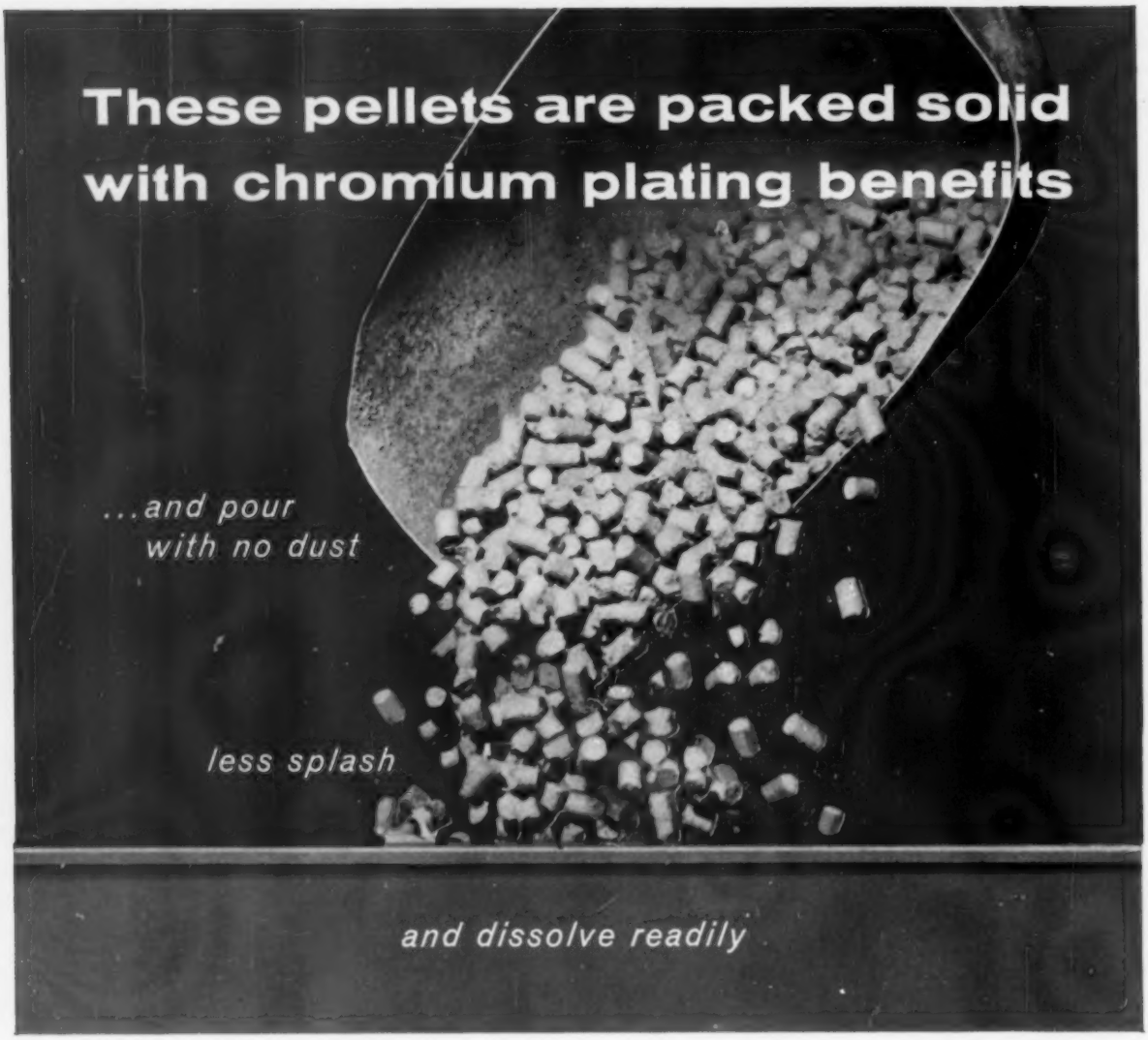

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EDITORIAL

PHYSIOLOGY AND AES's HEALTH AND STRENGTH

STRUCTURALLY, American Electroplaters' Society, Inc. (AES) can be likened, in effect, to the human body. The entire being, the "Body," is AES's membership. Its "Backbone" or "Spine," National Headquarters, holds the various elements of the "Body" together—coordinates and serves them—is the nerve conduit of the "Body" and the communications medium of the "Head," namely the Supreme Society and the Executive Board and AES's functional Committees and AES Branch leaderships. The "Head," in turn, is the echeloned control center of the organization.

And, of course, AES's 58 Branches and their six current Regional Groups or Regional Councils are the very muscles and sinews of the "Body"—and these are vitalized by AES's "Heart" which is the organization's driving mission to enrich technical and scientific knowledge and thereby stimulate advancements in electroplating, metal finishing and allied arts.

Just as the body of each of us requires sustenance for well-being and for strength and growth, so too does AES's "Body" need it in the form of more and more new members having a keen desire to be affiliated for self-improvement through education. For the general educational health and strength of the AES "Body," moreover, it needs nourishment through more widespread attendance and effective participation of Branch memberships at every Branch educational session.

As to AES "Body's" need for the benefits of durable growth, Branch Memberships can suitably be increased only by Branches themselves. First, there must be "desire" and "determination" to do so. Then, there must be thoughtful plan and widespread energetic effort to gain Branch goal, with all Branch hands lifting. And while expanding Branch Memberships, Branches should likewise concentrate upon increasing Sustaining Memberships. These provide the bulk of the financial wherewithal of the AES's vital Research Program embodying active Research Projects in American and Canadian universities and research foundations. Application Blanks for both purposes can be obtained from National Headquarters, together with membership promotion literature. In fact, an effective new promotional leaflet pinpointed to Branch Membership has already been issued under the aegis of the National Membership Committee supplementing National Headquarters' splendid more general booklet, "AES Membership: Its Meaning to You."

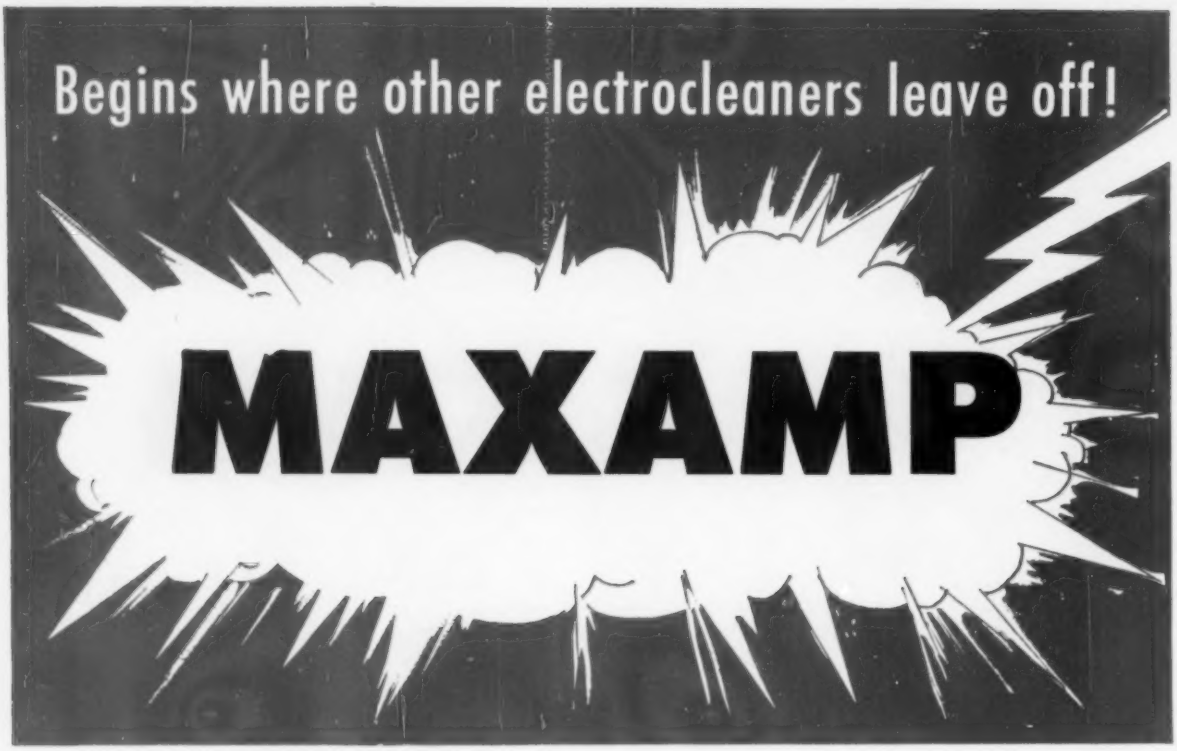
As to expanding habitual attendance by Branch Members at Branch monthly meetings, a MUST, this is another challenge to every Branch leadership. For central aid, the AES's 1959 Speakers List, for the first time including actual abstracts of talks offered by a host of listed speakers, was issued months ago to all Branches and is of priceless help. AES's goal for improvement is threefold, namely 1) more discerning scheduling of speakers and programs by Branches so as to provide the greatest possible appeal to the greatest possible number of Branch members; 2) more aggressive Branch direct mail promotion and oral push for each scheduled Branch meeting; and 3) improved reception of speakers by Branches, and the extending to them of every reasonable Branch courtesy and attention that a house guest has a right to expect when visiting by specific invitation.

All elements of the AES "Body" must contribute their share to further its health and strength and growth. Will YOU do YOUR share?

Chester G. Borlet

Second Vice-President
American Electroplaters' Society

PLATING MAGAZINE



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So, if you're interested in more efficient electrocleaning operations—and who isn't?—it'll pay you to investigate MAXAMP. It's the "new king of steel electrocleaners!" Call your Wyandotte representative for a demonstration, today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

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AS PLATING MAGAZINE OBSERVES ITS FIFTIETH ANNIVERSARY

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Ask to see a copy of our latest available ABC report. Ask, too, for our free booklet, "Market Data and Media File."

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✻ **100% VIRGIN NICKEL METAL FINES** – All Nuodex nickel plating chemicals are manufactured from virgin metal ores. No recovered, reprocessed or scrap nickel is ever used, to assure you the absolute minimum of impurities.

✻ **PROTECTED SOURCE OF SUPPLY** – The virgin metal used in Nuodex plating chemicals comes from an independent Canadian source. This is your insurance against possible future shortage.

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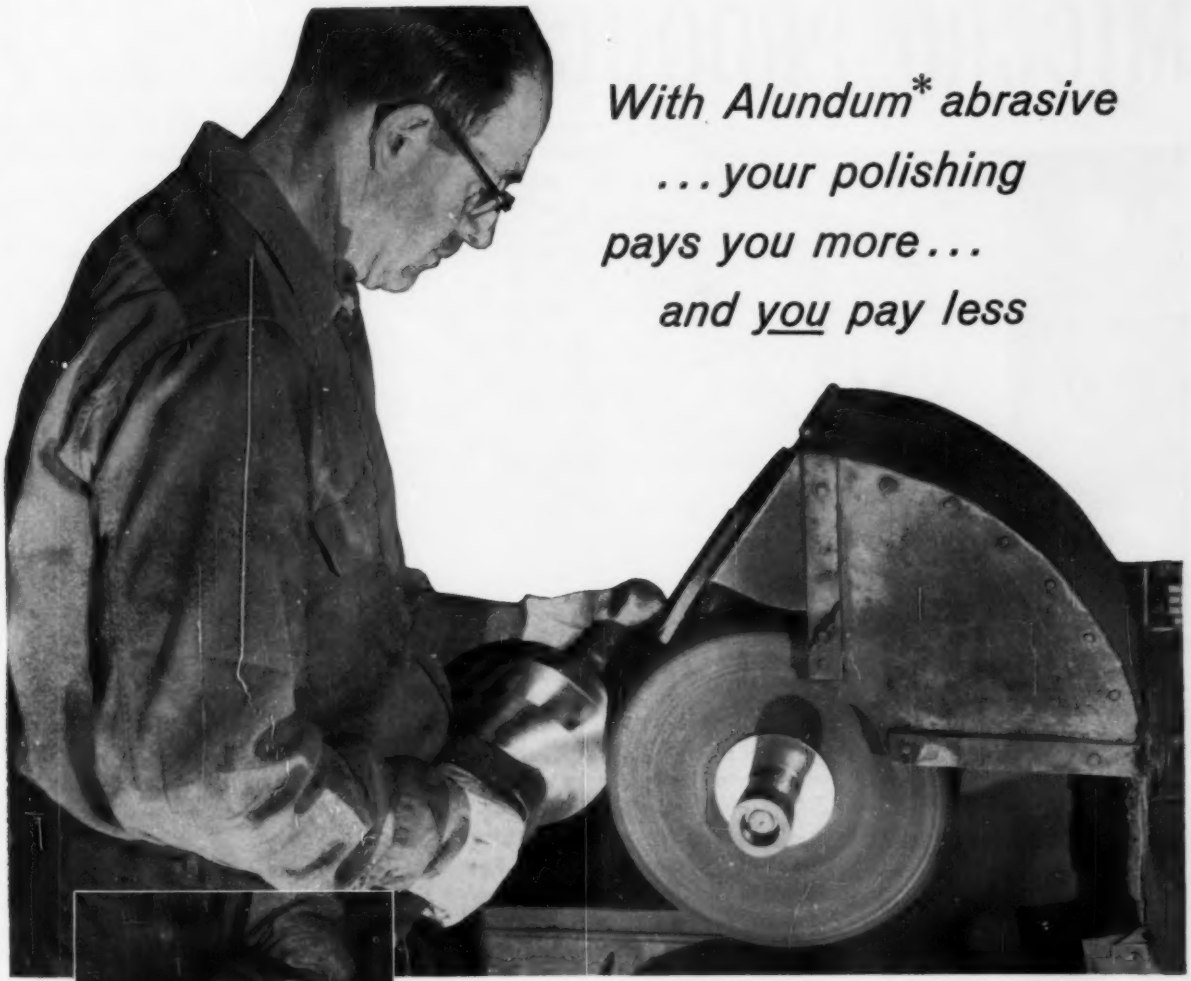
With Alundum abrasive ... your polishing pays you more... and you pay less*



A stainless steel floating ball, chief feature of a leading valve manufacturer's product, requires a high polish for its high efficiency. ALUNDUM abrasive is the leading manufacturer's selection for this important polishing job.

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Where finish is essential to product appeal or product efficiency, Norton ALUNDUM abrasives are the first choice in many plants. For extra long service life the blocky-shaped E_1 ALUNDUM B abrasive in grit sizes 14 to 240 is widely popular. For faster cutting action E_{122} ALUNDUM S abrasive (grit sizes 14 to 90) or E_{122} ALUNDUM R (grit sizes 100 to 240) are preferred.

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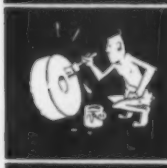
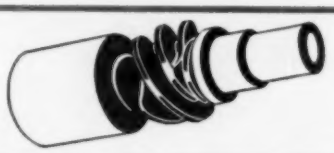
For extreme accuracy in masking parts for all plating cycles.



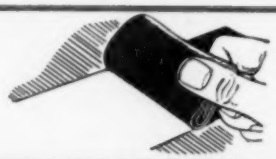
MICCROMASK

Provides complete masking protection for hard chromium plating.



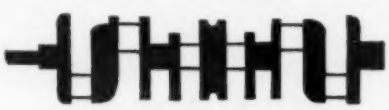
MICCROPEEL

A special lacquer that can be peeled easily from parts after all plating cycles.



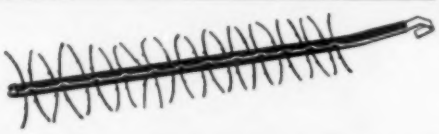
MICCROWAX

Two waxes widely used for selective stop-off. C-562 for hard chromium; C-600 for high-temperature cycles.



MICCROTEX

An air-dry rack coating for all plating cycles. Excellent for patching and repairing.



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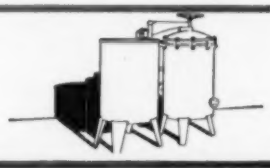
An extruded tape which provides unexcelled protection for plating racks, and for masking parts prior to selective plating.

MICCROTUBE

Extruded tubing especially suited for use on contact wires, and for selective plating of simple parts.

MICCROLOID

Corrosion-resistant industrial maintenance paint.



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Bi/NICKEL®

PROCESS

The combination nickel that's making plating history

only from Bi/NICKEL *do you get all these benefits*

1 SUPERB CORROSION RESISTANCE

Under actual exposure to highly corrosive atmospheres as well as accelerated CASS and Corrodkote tests Bi/NICKEL has proven its superiority over other bright nickel coatings.

2 THE MOST BEAUTIFUL FINISH

Color and brilliance obtained with Bi/NICKEL incorporating Udylite Bright Nickel, such as the Incomparable 66 and other Udylite nickel processes, cannot be matched.

3 ADHESION PROBLEMS LICKED

Bi/NICKEL offers a solution to adhesion problems previously considered inherent in combination nickel processes. Chrome finishes "take" to Bi/NICKEL with remarkable facility.

4 FULL RANGE OF COMBINATIONS

There is a version of Udylite's Bi/NICKEL which is adaptable to your product and problem whatever the demands of basis metal or the limitations of your already installed equipment.

5 INCREASED PRODUCT POTENTIAL

Here in Bi/NICKEL is a process that will immeasurably enhance the real value of the products to which it's applied. Longer life of usefulness and beauty can be expected from a Bi/NICKEL-Chromium finish. It gives you a real talking point when it comes to sales.

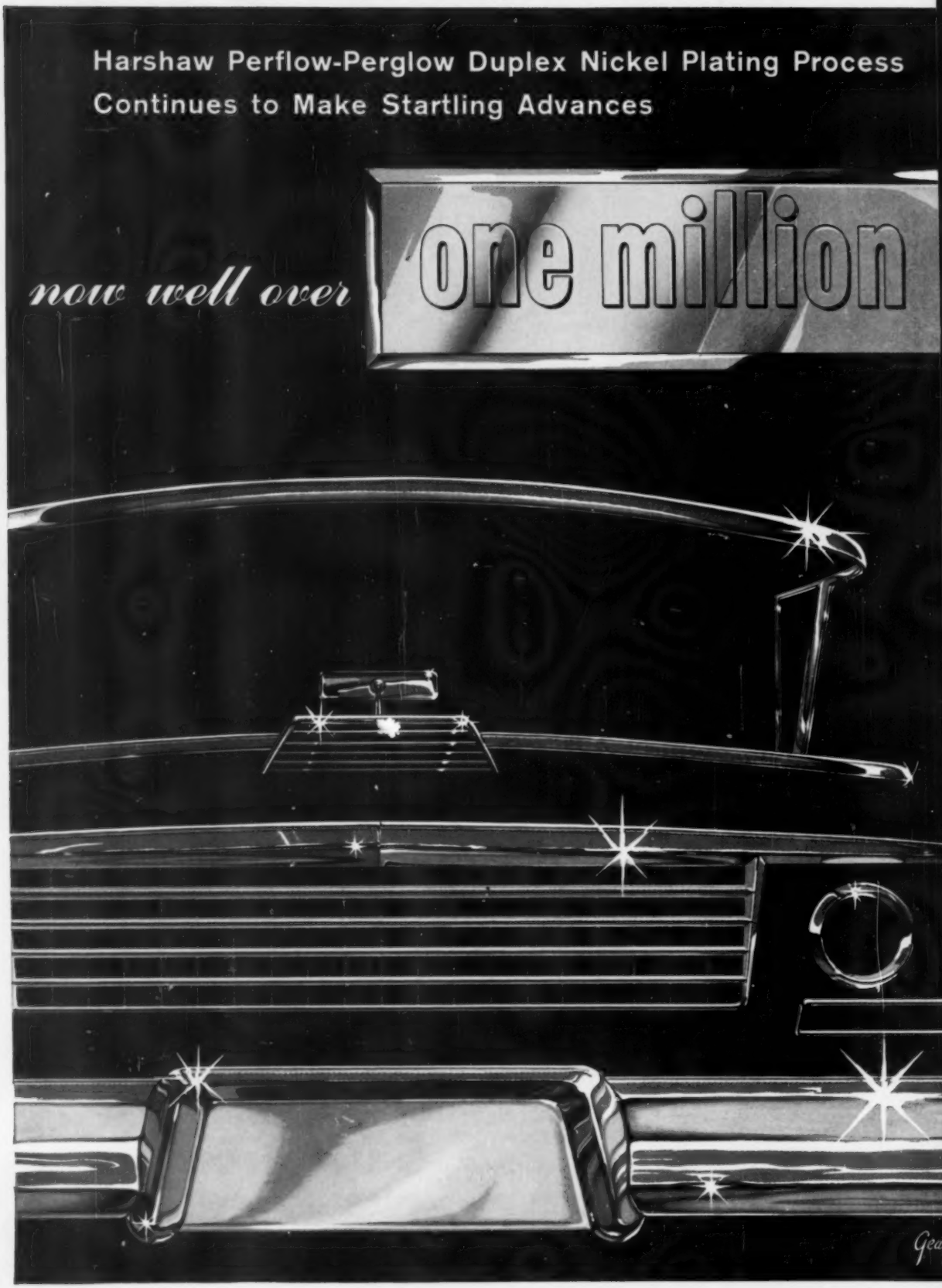
6 ANSWERS CUSTOMER COMPLAINTS

Bi/NICKEL is a step in the right direction toward solution of corrosion problems that have harassed automotive manufacturers and all others where corrosion has been a factor in a product's "life expectancy".

Discover TODAY how the Udylite Bi/NICKEL process is just what you've been looking for to meet and beat your corrosion problem.

you get Bi/NICKEL *only from* the udylite **corporation**

DETROIT 11, MICHIGAN
WORLD'S LARGEST PLATING SUPPLIER


Harshaw Perflow-Perglow Duplex Nickel Plating Process
Continues to Make Startling Advances
now well over
one million

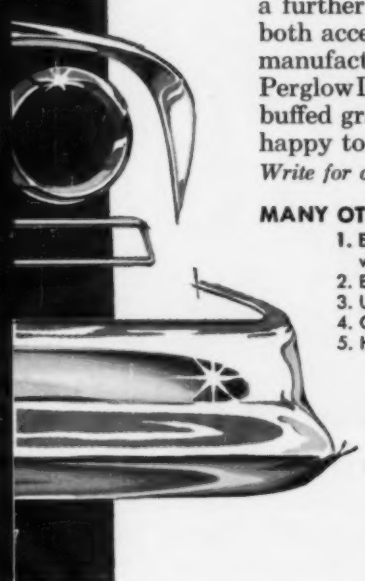
in operation

There is no more graphic way to demonstrate the superiority of this outstanding Harshaw development than to *state the facts:*

1. *ALL* 1959 domestic autos used external parts plated with Harshaw Perflow-Perglow Duplex Nickel (*On some models as high as 90% of the external parts.*)
2. Over Three Hundred Thousand gallons of Perflow-Perglow Duplex Nickel were installed between June 15 and September 15, 1959!

This is an amazing growth record, pointing up the undeniable fact that automobile manufacturers and their suppliers turn to the process which promises maximum corrosion resistance for their products—and in an ever-increasing wave they are turning to the Harshaw Perflow-Perglow Duplex Nickel Plating Process.

The Harshaw Chemical Company after years of research and development work was the first to find that a *sulfur-free* nickel offers greater corrosion resistance. This fact led to the development of the Harshaw Perflow nickel plating process. Further research showed that use of the sulfur-free Perflow nickel deposit as a base coating, followed by a bright nickel deposit from a *compatible* bath, would give a Duplex deposit with a further improvement of corrosion resistance. Performance data, by both accelerated tests and outdoor exposure, from leading automobile manufacturers and parts suppliers indicate that the Harshaw Perflow-Perglow Duplex nickel plate is comparable to and frequently better than, buffed gray nickel and is unequalled by any bright nickel. We shall be happy to discuss this process with you in person, or by phone or letter. *Write for our free booklet, "Harshaw's Complete Service to The Plating Industry."*



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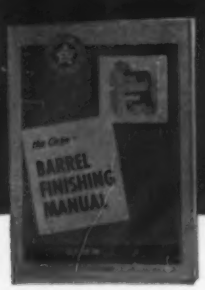

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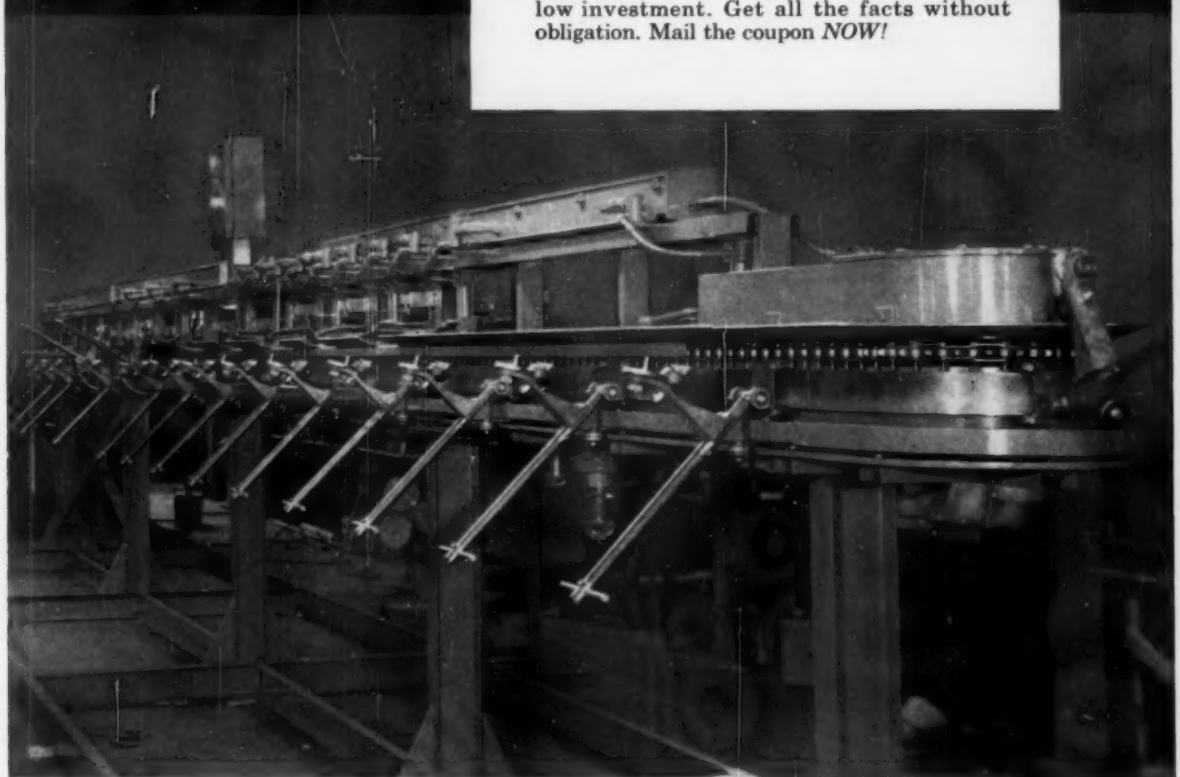

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In steak or plating, thickness counts. A good thick layer of Nickel under the chrome will give your product a finish that not only *looks* like quality but also *keeps* that look despite hard use.

Brushed Nickel-Chrome...an enduring finish that gives a quality look at a practical cost

Look at the door of this built-in oven ... at the top of the drop-in range.

The rich beauty you see is brushed Nickel-Chrome Plating.

You may have heard of this finish as "brushed chrome" or "satin chrome." By any of these names, brushed Nickel-Chrome Plating offers you a way to dress up your products at little – if any – increase in production cost!

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Quality Appearance. A brushed Nickel-Chrome finish tells your customer that the article he is buying is of high quality – inside as well as on the surface.

Durability. This finish keeps on saying "quality" despite hard use. One or even two punishment-taking layers of Nickel, flash-coated with chrome, resist nicking, scratching, wearing, and corrosion. What's more, this finish resists staining, is easy to clean.

Easy to Fabricate. Brushed Nickel-Chrome can be ... is being applied to all the easy-to-fabricate metals – steel, zinc, aluminum, copper, brass – to take advantage of the physical and mechanical properties of these metals. Less common metals can also be readily plated.

Versatility. Brushed Nickel-Chrome has many unique advantages. For example, by selective buffing, you can get bright trim effects without using trim hardware.

Practical Cost. Experience of manufacturers already using brushed Nickel-Chrome shows that this eye-catching finish costs only a few pennies more than ordinary finishes.

With Nickel in ample supply as far into the future as any man can see, you can take advantage of brushed Nickel-Chrome Plating to give your products extra sales appeal. For more ideas, write for our booklet, "Practical Answers to 40 Practical Questions about Nickel Plating."

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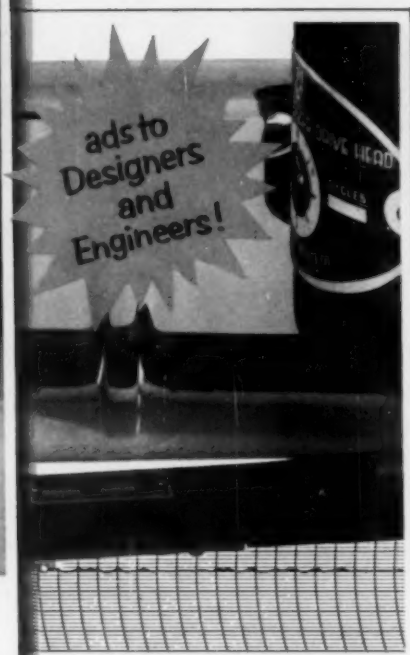
INCO Inco Nickel... *makes plating perform better longer*



...th 2 mils of leveling Nickel and 0.01 mils of chrome ...h level reading of no more than 5 to 6 micro-inches.

...leveling Nickel takes ...costs out of plating

...quality, too. Leveling ...ted semi-bright, are ...h bright Nickel be... ...g. The thick, duplex ...that results assures ...and lasting beauty. It ...rror-smooth, white- ...for a brilliant blue- ...backs up the chrome ...against cracking — ...etals from rust and ...in ample supply as far into the future as any man can foresee, you can now plan to use leveling Nickel Plating to cut your production costs and enhance plating quality.

For more information about versatile Nickel coatings, write us for our informative booklet, "Practical Answers to 40 Practical Questions About Nickel Plating."

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polishing and buffing costs.

INCO Inco Nickel *makes plating perform better longer*

How these Nickel Plating ads help you

These two advertisements illustrate one of the many things we are doing to expand the Nickel Plating market. Our plan is simple:

Give the people who influence the selection of finishes useful, helpful information on what Nickel Plating can do for the products they make.

For example, we are telling the appliance manufacturers about brushed Nickel-Chrome Plating for built-in oven doors and drop-in range tops and other appliances.

We're pointing out the possibilities of leveling Nickel Plating to the designers and engineers who could be taking greater advantage of plating to improve the appearance – and sales – of the products they design and produce.

And we're explaining to automobile manufacturers about duplex Nickel-Chrome Plating . . . how a thick layer of semi-bright Nickel followed by a layer of bright Nickel plus a flash of chrome provides the most durable outdoor finish for automobile brightwork.

That's not all. Another of the giant steps we're taking to boost the use of quality Nickel Plating is our new $115 million mining project in Manitoba – developed to assure *continued supplies of all the Nickel you need!*

You can take advantage of this increased activity and interest in Nickel Plating by keeping posted on all the latest developments in this industry. One way to do it is to write for our technical bulletin, *Practical Nickel Plating.* Yours on request.

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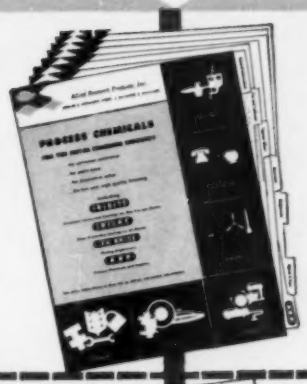

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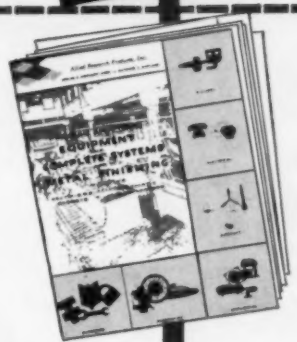

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Radioisotopes for Industry by Robert S. Rochlin and Warner W. Schultz, Nonmembers $4.75, AES members $4.00.

This book is, as stated on the jacket, "A current survey of specific applications." It does not presume special knowledge and should be of value to any reader who wants a summary report of today's industrial uses of radioisotopes. Most of the present known techniques of applying radioisotopes to industrial problems are dealt with. The fundamental principles employed are discussed qualitatively and then several examples employing these principles are described. Considerable attention is given to research and development applications of radioisotopes and to short term tests employing tracers in manufacturing facilities. Techniques such as autoradiography, activation analysis, and diffusion measurement systems are briefly described together with applications. While the number of illustrative applications mentioned in the book falls far short of those actually available in the literature, the authors have chosen their illustrations wisely and well. Most illustrations deal with actual uses. Where a proposed use is cited as an example, the fact that the technique has not yet been applied is carefully stated. References to investigations in the electrochemical field are, unfortunately, lacking but a study of the chosen examples should lead to intelligent guesses concerning possible applications of these various techniques in other fields. Material presented concerning wear measurements, activation techniques, tracer studies, and means of chemical control utilizing neutron sources is sufficient to point the way toward many applications in the electrochemistry field.

A short chapter on radiation safety presents the fundamental safety considerations peculiar to radioisotope work together with reference material concerning applicable rules and regulations. Problems associated with the selection of equipment and the planning of necessary physical facilities are dealt with briefly. The need for trained personnel is emphasized and a short section is devoted to describing ways in which formal training in radioisotope technology can be obtained.

A 13-page bibliography contains a number of selected references on all topics dealt with in this book. It should provide ample reference material for those who wish to delve deeper into any phase of industrial radioisotope utilization.

A. SOMERVILLE
Supervisor, Physics Dept.
Isotope Laboratory, General Motors Corp.

The Preparation and Characteristics of Thin Ferromagnetic Films. Air Force Cambridge Research Center. Nov. 1958. 139 pages. (Order PB 151525 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., $2.75.)

Thin nickel-iron alloy films with characteristics suitable for use in computers can be prepared both by an electrochemical process and by thermal decomposition of acetyl acetonate on a wide variety of substrates, this study determined. The films are produced with a wide range of compositions, thicknesses, and magnetic properties. By the thermal-decomposition technique, films are made with rectangular hysteresis loops independent of the orientation of the sample in the test equipment. Electrodeposited samples can also be prepared with rectangular hysteresis loops in orthogonal directions. In addition, they can be deposited with properties similar to vacuum-deposited films. Equipment developed during the study included apparatus for measuring the 60-cycle hysteresis loops under stress and at various angles of rotation. Switching equipment capable of measuring switching times from 20 millimicroseconds to a few microseconds, with and without cross fields, was also devised. Chemical methods were developed for analysis of chemical composition and thickness of microgram quantities of nickel-iron alloys plated on a variety of metallic and nonmetallic substrates. *(Continued on page 229)*

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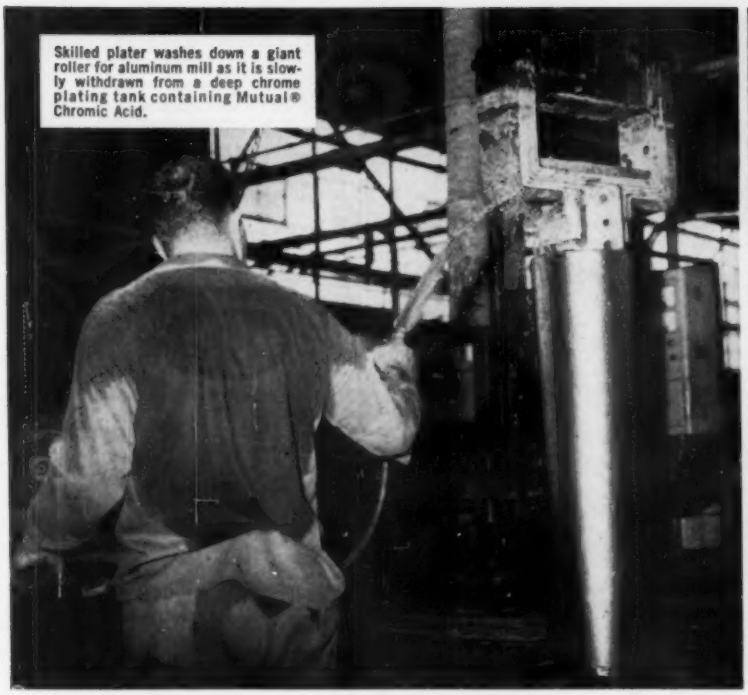
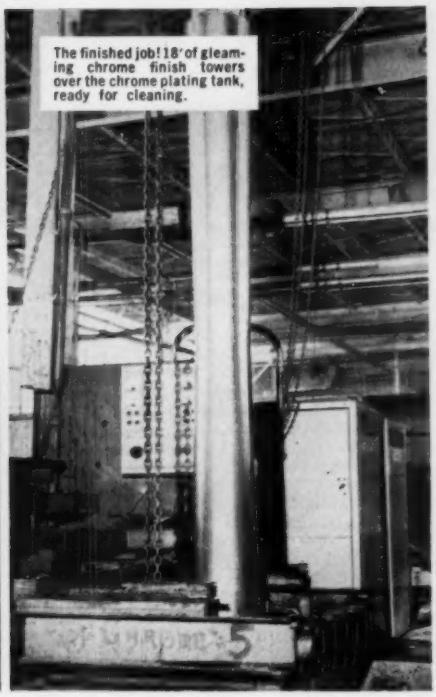


Skilled plater washes down a giant roller for aluminum mill as it is slowly withdrawn from a deep chrome plating tank containing Mutual® Chromic Acid.



The finished job! 18′ of gleaming chrome finish towers over the chrome plating tank, ready for cleaning.

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Like many other skilled platers throughout the country, Simmons relies on high purity Mutual Chromic Acid to provide a chrome plate that gives longer wear and resistance to rust and corrosion. Plating with Mutual Chromic Acid also helps to protect the rollers from damaging or scratching the aluminum ingots they convey.

Mutual Chromic Acid is always 99.75% pure—or better. Sulfate content never exceeds 0.1%. Rigid quality control insures that the chromic acid you get is always the same. This makes it easier for you to control accurately the chromic acid-sulfate ratio of your plating bath.

For information on Mutual Chromic Acid, as well as other Mutual chromium chemicals, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service staff will also be happy to answer your questions.

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The unique book contains the full text of each of the 43 technical papers on electroplating, metal finishing, organic coating and allied arts by experts of nine countries, including the United States, England, Canada, Australia, France, Germany, Holland, India and Italy, delivered before the Fifth International Conference on Electrodeposition and Metal Finishing, educational sessions element of the AES's Golden Jubilee Convention held in Detroit, Michigan, June 15–19, 1959.

Embodying, too, the charts, diagrams graphs, tables and other illustrations of each of the 43 published papers, *the book also includes the transcript of the discussion that attended the delivery of each paper*. A full list of the papers published in this voluminous treasure chest of knowledge appears on the facing page of this announcement.

Spanning some 400 pages (by far the largest annual TECHNICAL PROCEEDINGS ever published by the AES in its half-century lifetime), this 1959 edition also includes, among other data, a day-to-day log of the Golden Jubilee Convention; a section on the AES Scientific Achievement Award and on other AES technical and scientific awards and honors bestowed at the Golden Jubilee Convention; a full listing of the Boards and Standing and Special Committees that served the AES during its Fiftieth Anniversary year, and a complete AES Branch Directory.

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A LIMITED extra quantity of the book has been printed to meet the sizable interest shown in it by AES non-members internationally. Orders for copies of the book are now invited from AES non-members, and will be accepted on strictly a "first come-first served" basis so long as that extra supply lasts. The book is unavailable elsewhere.

Within the continental limits of the United States, the domestic price of this Golden Jubilee Edition of AES's TECHNICAL PROCEEDINGS (1959) is $20 per copy including postage.

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INTERNATIONAL CONFERENCE: ITS AES HALF-CENTURY SETTING

DRAMATIC and fitting climax of its year-long FIFTIETH ANNIVERSARY observance, American Electroplaters' Society, Inc. (AES) conducted its unique Golden Jubilee Convention and Industrial Finishing Exposition, including the concurrent Fifth International Conference on Electrodeposition and Metal Finishing, in Detroit, Michigan, June 15-19, 1959.

GREETED by the President of the United States, the AES was welcomed to Michigan and Detroit by Governor G. Mennen Williams. The entire week of the AES's Convention, Exposition and International Conference was proclaimed by Detroit's Mayor as "AES GOLDEN JUBILEE WEEK IN DETROIT."

AS the Fifth International Conference on Electrodeposition and Metal Finishing, the Golden Jubilee Convention's educational sessions numbered eleven. Experts from nine countries, including the United States, England, Canada, Australia, France, Germany, Holland, India and Italy, presented 43 technical and scientific papers enriching knowledge in electroplating, metal finishing and allied arts. High spot of the sessions was the first "William Blum Lecture" that was delivered by the eminent Dr. William Blum, first winner of the AES Scientific Achievement Award, the Society's highest honor.

UNDER the supervision of the AES's Editorial Board, in collaboration with the International Council on Electrodeposition and Metal Finishing, the International Conference was planned for the AES by AES Past President Walter L. Pinner, Chairman of the International Council. His Committee included Dr. T. P. Hoar, Dr. Simon Wernick, A. W. Wallbank, R. A. F. Hammond and George Gardam of England and Myron B. Diggin, Dr. Walter R. Meyer and Dr. Richard B. Saltonstall of the United States.

OPENING SESSION OF THE FIFTH INTERNATIONAL CONFERENCE ON ELECTRODEPOSITION AND METAL FINISHING

(1) Chairman Walter L. Pinner extending official welcome. Dr. William Blum, AES Scientific Award winner, seated. (2) Crowded auditorium at the first session. (3) Session Chairman T. P. Hoar introducing Dr. Blum, who delivered the first William Blum Lecture.

From **H-VW-M** Research:

2 NEW NICKEL-PLATING PROCESSES

Here's good news...two new nickel processes...and more to come!

PERMALUME Semi-Bright Process

This fast-plating air-agitated bath is ideal for today's duplex-coating systems. *Permalume*, the simplest bath to operate, will not form harmful reduction or hydrolysis products. It is easy to analyze. There is no breakdown in brightness. It's the *only* semi-bright bath that can be continuously filtered through carbon without loss of addition agents! Semi-bright *Permalume* deposits are sulfur-free and are used in duplex systems with a bright top coat of *Levelume*.

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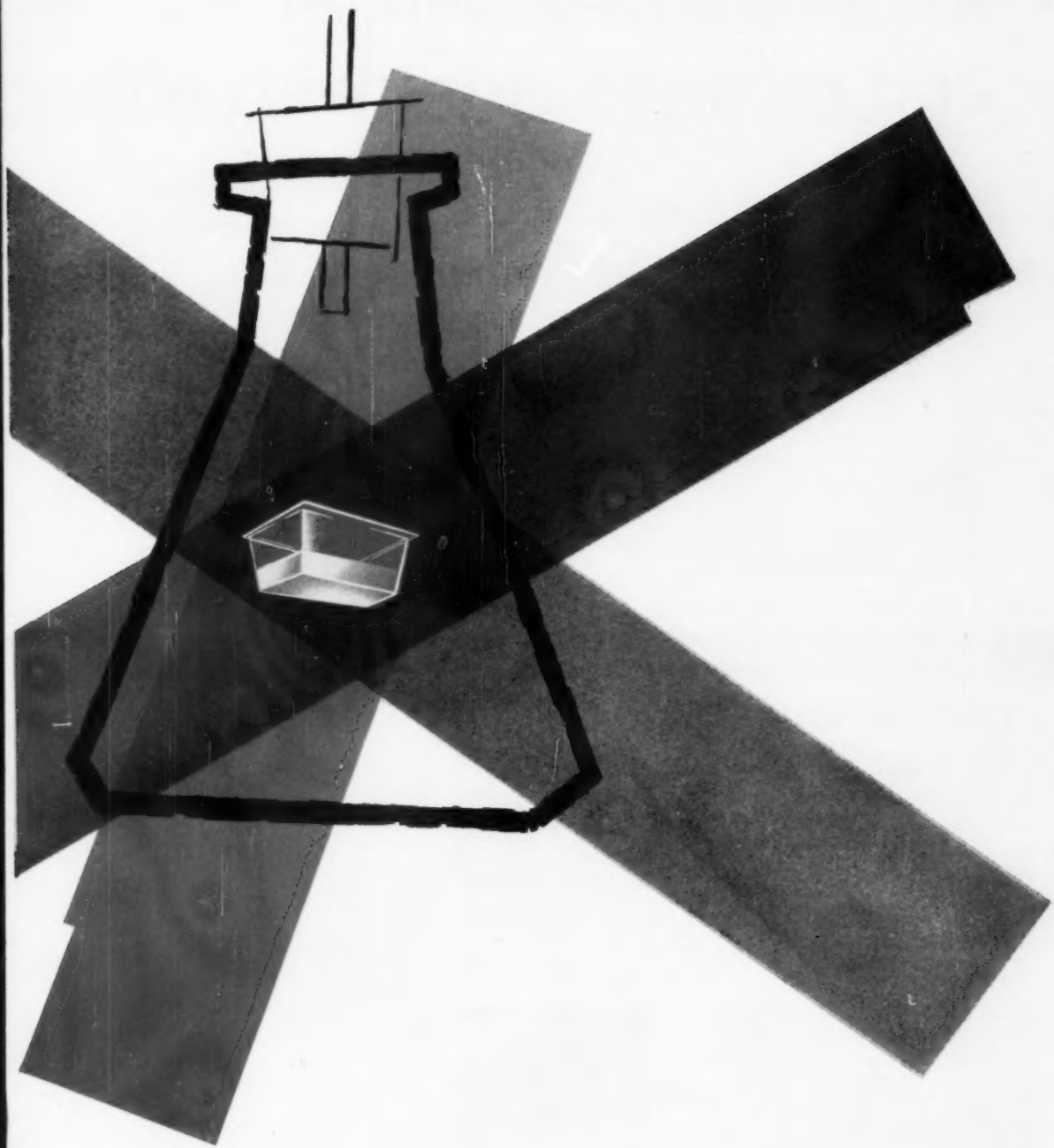
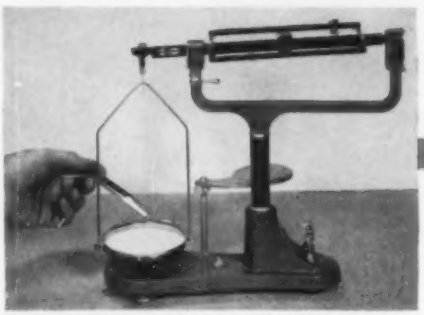


H-VW-M

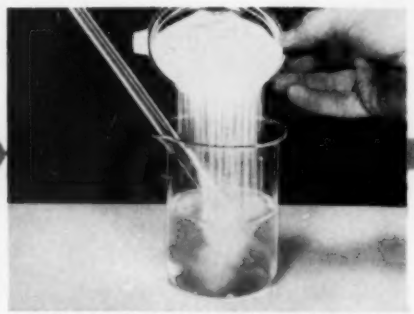
Progress in metalfinishing through advanced processes • equipment

Here's how you can save time, and mixing errors with either

New "Direct-Route" Method



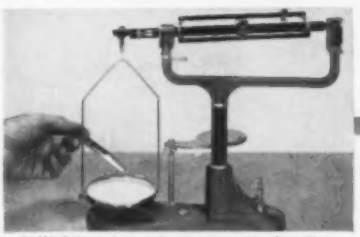
1 Just weigh required amount of sodium-copper or potassium-copper double salt.



2 Dissolve the desired double salt in water or plating solution.

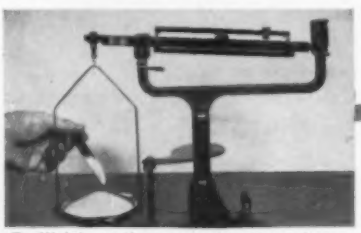
Laboratory demonstration shows how "direct-route" method saves time

Old "Indirect" Method



1 Weigh out required amount of sodium or potassium cyanide.

2 Dissolve the sodium or potassium cyanide in water.



3 Weigh out the required amount of copper cyanide.

4 Add copper cyanide to water and make a slurry.

5 Dissolve the copper cyanide slurry in solution of sodium or potassium cyanide.

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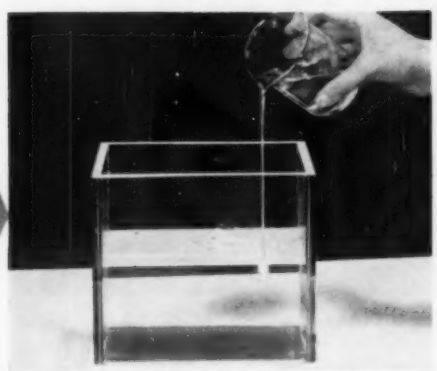
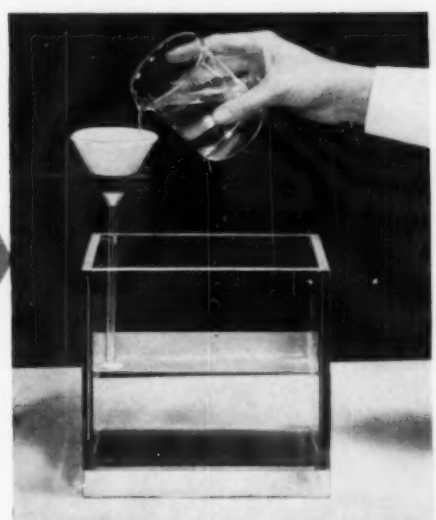
reduce handling, avoid waste of Du Pont's Double Salts...



3 Add directly to plating tank—no filtering necessary.

...avoids errors.



6 Add solution through a filter to plating tank.

SODIUM-COPPER CYANIDE OR POTASSIUM-COPPER CYANIDE

SAVE TIME AND REDUCE HANDLING...By using one Du Pont copper cyanide double salt instead of two separate chemicals, you eliminate several steps usually required to dissolve copper cyanide. Just weigh out the Du Pont double salt and dissolve it in water or plating solution. A "direct-route" process! (Compare old and new methods at left.)

AVOID WASTE AND MIXING ERRORS...because active ingredients are in the proportions usually required. This simplifies making and replenishing bath . . . prevents waste resulting from undissolved copper cyanide.

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SIMPLIFY CALCULATIONS...Balanced composition of Du Pont double salts makes it easy to determine amounts required for make-up or replenishment. (1 oz. potassium-copper cyanide double salt is equivalent to 0.26 oz. copper, or 0.37 oz. copper cyanide; 1 oz. sodium-copper cyanide double salt is equivalent to 0.29 oz. copper or 0.41 oz. copper cyanide.)

SODIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	28.7% min.	29%
"Free" sodium cyanide	0.4 to 2.0%	1%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	0.01%

POTASSIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	25.8%	26.3%
"Free" potassium cyanide	1.25% to 3.0%	2.9%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	Trace

Both potassium and sodium double salts are shipped in convenient moisture-resistant 100-lb.-net fiber containers.

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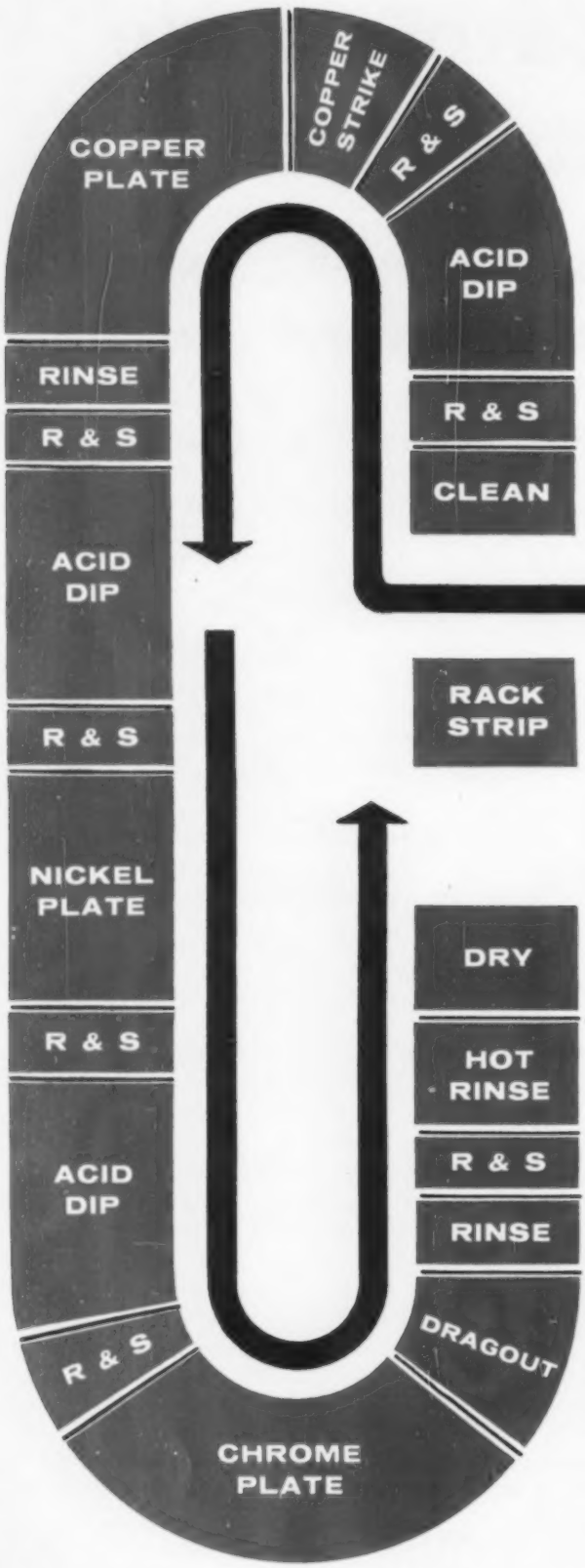

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HYDROGEN EMBRITTLEMENT OF HIGH-STRENGTH STEELS DURING CADMIUM, CHROMIUM AND ELECTROLESS NICKEL PLATING

by WILLIAM L. COTTON*

Delayed, brittle failures of stressed high strength steel parts have resulted from hydrogen pick-up during plating processes. Embrittlement resulting from cadmium, chromium and electroless nickel plating was evaluated using five representative aircraft steels heat-treated to various tensile strengths up to 300,000 psi. This was accomplished by static loading plated specimens to a minimum of 75 per cent of the notched ultimate tensile strength and determining the time to failure.

1. The following low-embrittlement processes were proved satisfactory for low-carbon alloy steels heat-treated up to the 280,000 psi strength level;
   a. "High Efficiency Cadmium" plating followed by a 23 hour bake at 375F.
   b. Passivation of cadmium plating to meet the corrosion requirements of Federal Specification QQ-P-416a.
   c. Hard chromium plating followed by a 23 hour bake at 375F.
   d. Electroless nickel plating followed by a 23 hour bake at 375F.
2. The following processes were proved satisfactory for plating a high-silicon AISI 4340 type steel heat-treated in the range of 270,000 to 300,000 psi.
   a. Conventional bright cadmium plating followed by a 23 hour bake at 375F.
   b. Hard chromium plating followed by a 3 hour bake at 550F.
   c. Electroless nickel plating followed by a 3 hour bake at 550F.

INTRODUCTION

DELAYED, BRITTLE FAILURES of stressed high strength steel have occurred at relatively low stresses. These failures have been attributed to the presence of hydrogen in the steel. This hydrogen is introduced by reaction with water or with acid or by cathodically discharging (plating out) hydrogen at the surface of the steel.

There is no particular strength level above which steel is sensitive to hydrogen embrittlement and below which embrittlement does not occur. Electroplating processes result in perceptible embrittlement of steel at the 160 KSI† strength level increasing to acute embrittlement at the 300 KSI level. To insure against hydrogen embrittlement, the Military has required[1] that all processes for plating steel parts heat-treated to strength levels above 220 KSI be reviewed by the procuring Service.

The basic mechanism of delayed, brittle failure (static fatigue) has been described[2, 3] as a three-stage process consisting of crack initiation or incubation, followed by crack propagation, and finally, failure when the tensile strength of the remaining uncracked metal is exceeded. Atomic hydrogen is thought[3, 4, 5] to diffuse to the region of maximum triaxial stress and to precipitate as molecular hydrogen in internal voids, building up pressure until cracks are initiated. Crack propagation occurs (as an accelerated succession of crack initiations) at a relatively constant rate until the fracture strength of the uncracked material is exceeded and rupture occurs.

The incubation period for crack initiation depends upon the triaxial stress state and upon the hydrogen concentration in the region of maximum triaxiality. The movement of hydrogen into this region is controlled by the diffusion rate of hydrogen in steel. The length of the incubation period for a given triaxial stress state will, therefore, depend primarily upon the average hydrogen concentration.

In the light of the above, it is apparent that embrittlement may be minimized by limiting the introduction of hydrogen into the steel during processing, by expelling the entrapped hydrogen, and by redistributing the entrapped hydrogen so that it is nowhere concentrated at a dangerous level.

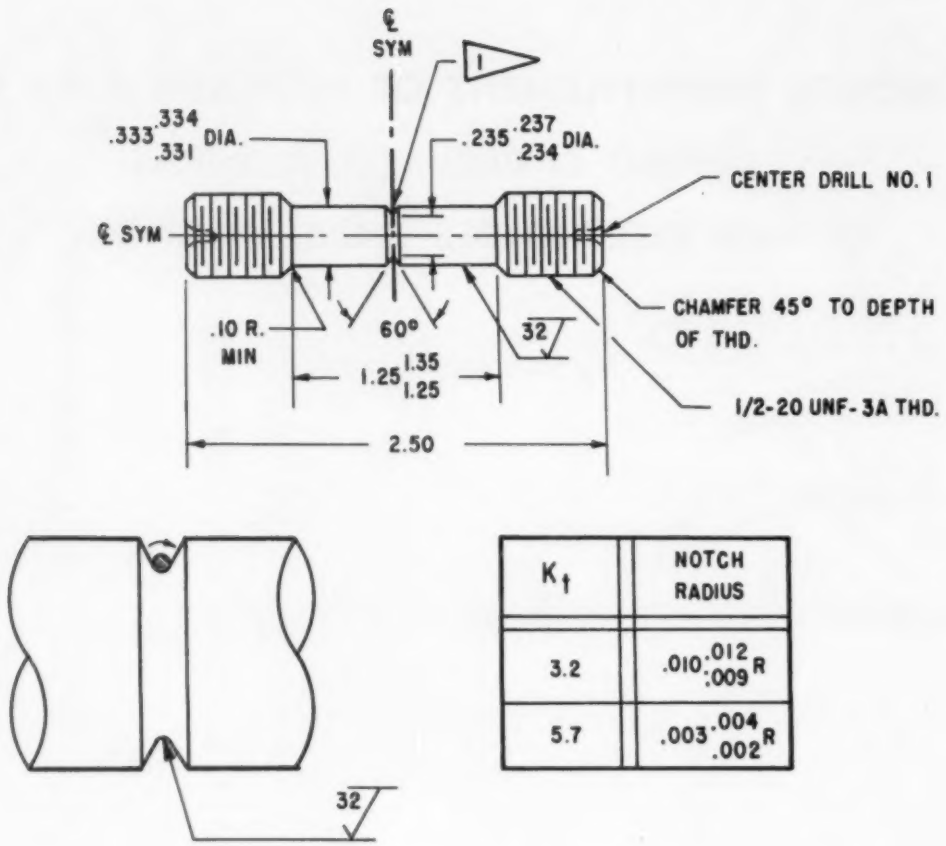
SELECTION OF A TEST PROCEDURE

A number of tests have been used in evaluating hydrogen embrittlement. The tests most commonly used include (a) Dynamic Bend, (b) Dynamic Tensile (smooth or notched), (c) Static Bend (smooth or notched) and (d) Static Tensile (usually notched). Each of these tests has its peculiarities. Dynamic tests will not always detect hydrogen embrittlement if the test duration is less than the incubation period for crack initiation. Static tests are time consuming and usually require the use of expensive notched specimens in order to achieve reliability.

Preliminary studies confirmed the relative insensitivity and lack of reproducibility reported[6] for the Dynamic Tensile and (smooth) Static Bend tests. These evaluations were based upon reduction in area for the dynamic test and upon time to failure of stressed ring and of stressed plate specimens for the static test.

*Research Chemist, Boeing Airplane Company.

†1 KSI = 1,000 Pounds per Square Inch.



K_t	NOTCH RADIUS
3.2	.010 .012 .009 R
5.7	.003 .004 .002 R

DIRECTION OF GRAIN LONGITUDINAL

1 USE LIGHT FINISHING CUTS TO MACHINE NOTCH.

POLISH NOTCH WITH RAPIDLY ROTATING WIRE IN A SLURRY OF OIL AND ABRASIVE.

Fig. 1. Specimen for Hydrogen Embrittlement Testing—The shank was ground to size and the notch machined to size using a single point tool. The notch root was polished to eliminate tool marks and to thus reduce data scatter during testing.

The Static Notched Tensile test was selected for further evaluation and is the basis for the data reported herein. This was considered to be the most applicable test because it most nearly simulated conditions encountered in service and because of its extreme sensitivity. The specimens used were notched to produce a geometric stress concentration factor of either $K_t = 3.2$ or $K_t = 5.7$ (Nominal notch radius 0.010 or 0.003 inches respectively.[7]—Fig. 1).

The value of $K_t = 3.2$ was chosen for qualification tests because the ratio of the notched UTS* to the unnotched UTS equalled about 1.4 and changed very little with change in notch acuity. Thus, a notch radius range of 0.009 inches to 0.012 inches could be used to minimize the effects of slight differences in notch radius due to machining errors.

The value of $K_t = 5.7$ was chosen for critical evaluations to take advantage of the increased sensitivity of sharp notched specimens to static fatigue (due to the higher triaxial stress state). A more severe notch than $K_t = 5.7$ (nominal notch radius of 0.003 inches) was not considered practical because of the difficulty involved both in machining and plating the root of the notch. Microscopic studies of specimens having a $K_t = 5.7$ indicated that the plating was satisfactory in the area of the notch root (Fig. 2).

Embrittlement was evaluated by stressing the notched specimens in a specially designed static test machine (Fig. 3 and 4) which was essentially a dead-load lever type creep machine. The loads were set using calibrated dynamometer bars and were based upon the net area at the notch root prior to plating. A micro-switch was used to interrupt an electric timer and thus indicate the test duration.

*UTS = Ultimate Tensile Strength

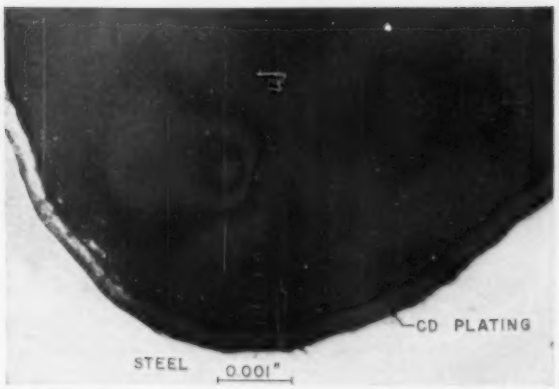


Fig. 2. Notch Root of Cadmium Plated Specimen—Unetched—This photomicrograph shows the uniform coating of the notch root of an AMS 6427 specimen having a K_t = 5.7 (Notch radius 0.003 inches). This specimen has been plated with 0.0005 inches of standard bright cadmium.

The effect of applied constant stress upon the static fatigue life of two typical plated steels is shown in Fig. 5 (Tests 8 and 16). Two limits of considerable theoretical interest are the upper and lower critical stresses. The upper critical stress is that stress at which failure occurs during loading. This stress, sometimes referred to as the charged notch tensile strength, approaches the value of the notched UTS for uncharged (normal) steel as the hydrogen concentration is decreased. The lower critical stress is defined as that stress below which a load is sustained indefinitely and above which failure occurs in a finite time. Delayed failure, then, occurs over a wide range of applied stresses between the upper and lower critical stresses. The time to failure (static fatigue life), the lower critical stress and the upper critical stress increase with (a) decreasing hydrogen concentration, (b) increasing hydrogen diffusion coefficient, and (c) decreasing notch severity (i.e., increasing notch radius—see Fig. 1). The static fatigue life further depends upon the applied stress—increasing as the applied stress decreases and approaches the lower critical stress.

TABLE I
CHEMICAL COMPOSITION OF STEELS

Constituent	AMS 6427 Steel	AMS 6407 Steel	AMS 6418 Steel	AISI 4340 Steel	4340-1.5 Si Steel
Carbon	0.30	0.28	0.28	0.42	0.38
Manganese	0.88	0.74	1.28	0.78	0.46
Silicon	0.30	0.62	1.40	0.21	1.64
Nickel	1.80	2.08	1.75	2.05	2.05
Chromium	0.86	1.15	—	0.85	0.98
Molybdenum	0.45	0.44	0.38	0.29	0.36
Phosphorus	0.014	0.017	0.024	0.026	0.010
Sulfur	0.014	0.013	0.010	0.011	0.017
Vanadium	0.08	—	—	—	0.06
Aluminum	—	—	—	—	0.095

CRITERION FOR ACCEPTANCE OF LOW EMBRITTLEMENT PROCESSES

A plating (or passivating) process was judged to be acceptable for the steel and for the level of heat-treatment tested, if the plate was deposited in the notch root, if the plate was adherent, and if four out of four specimens withstood a static load of 75 per cent of the notched UTS (K_t = 3.2) for 150 hours without failure, i.e., the lower critical stress was greater than 75 per cent of the notched UTS. Comparative ratings of processes were based upon the lower critical stress and to a lesser extent upon time to failure at 75 per cent loading.

PREPARATION OF SPECIMENS

Five aircraft quality steels were used in this investigation: AMS 6427, AMS 6407, AMS 6418, AISI 4340, and 4340–1.5 Si. All five alloys possessed good ductility when heat-treated to

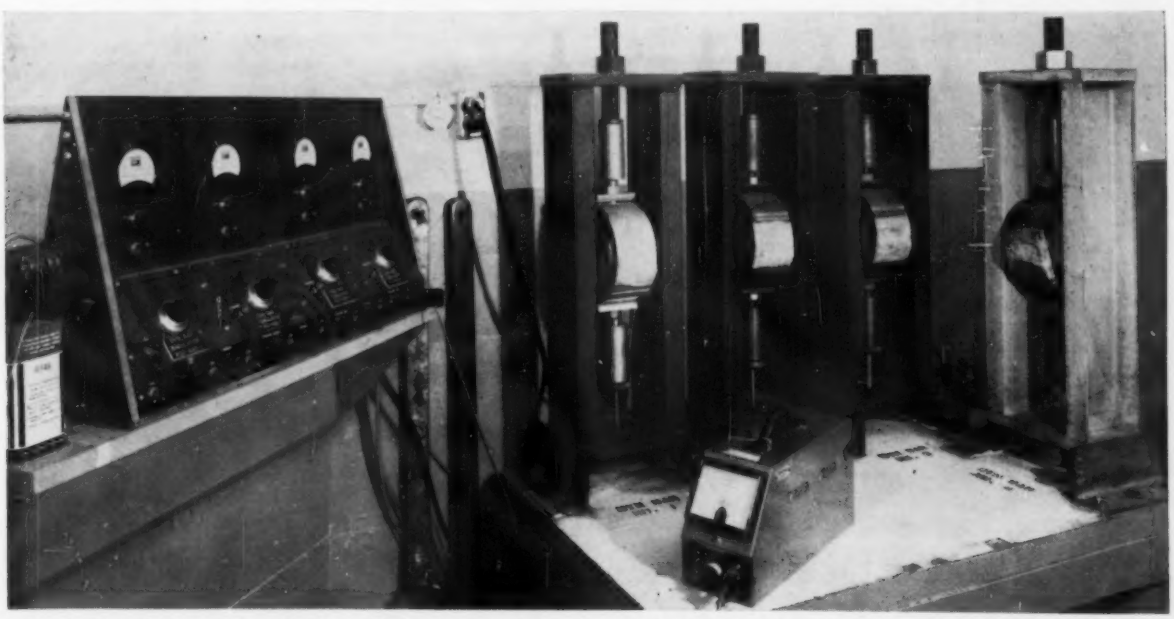


Fig. 3. Overall View of Static Test Jigs—The load was applied to the specimen by turning the nut located on top of the supporting frame and was measured by means of strain gages placed on the dynomometer ring.

TABLE II
HEAT-TREATMENT OF STEELS

Operation	AMS 6427 Steel	AMS 6407 Steel	AMS 6418 Steel	AISI 4340 Steel	4340-1.5 Si Steel
Normalize (1 hr)	1700F	1700F	1700F	1650F	1700F
Austenitize (1 hr) and Oil Quench	1600F	1600F	1575F	1500F	1600F
1st Temper	575F	525F	600F	450F	600F
Time	3 hr	3 hr	3 hr	4 hr	2 hr
2nd Temper	575F	525F	600F	——	600F
Time	3 hr	3 hr	3 hr	——	2 hr
Heat-Treat Level	220–240 KSI	220–240 KSI	220–240 KSI	260–280 KSI	270–300 KSI
Average Notched UTS (K_t = 3.2)	330 KSI	——	——	360 KSI	376 KSI
Average Notched UTS (K_t = 5.7)	308 KSI	341 KSI	340 KSI	——	359 KSI
Average Hardness	R_c 46	R_c 48	R_c 47	R_c 52	R_c 54

high strength levels. Compositions and heat-treatment data for these steels are given in Tables I and II.

Test specimens were rough machined, heat-treated, and finish machined per Fig. 1. A number of specimens were slowly stressed to failure to determine the average notched UTS for each set of specimens heat-treated. Test specimens were anodically cleaned for five minutes, rinsed, anodically etched for five minutes, allowed to drain one minute (to simulate transfer time), rinsed, plated immediately, and baked. The following solutions were used:

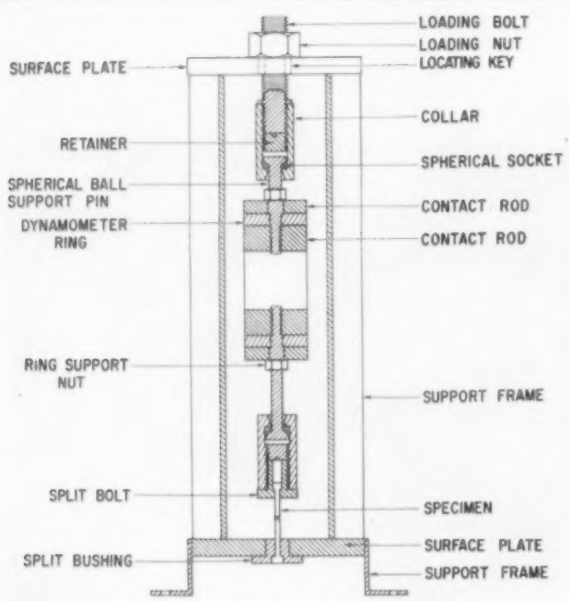


Fig. 4. Cutaway View of Static Test Jig—In order to prevent eccentric loading of the specimens, all flat loading-surfaces were faced-off normal to the channel supports within ± 1°, all holes were line drilled on center-line within ± 0.01° in. and perpendicular to the surface plates within ± 1°, and spherical ball joints were provided above and below the dynomometer ring.

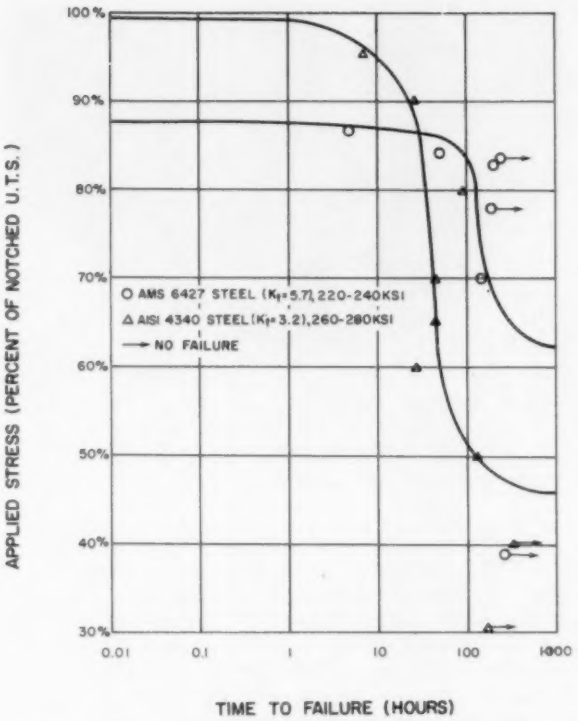


Fig. 5. Effect of Applied Stress Upon Static Fatigue Life—Specimens have been plated with 0.0005 inches of standard bright cadmium and baked 8 hours at 375F.

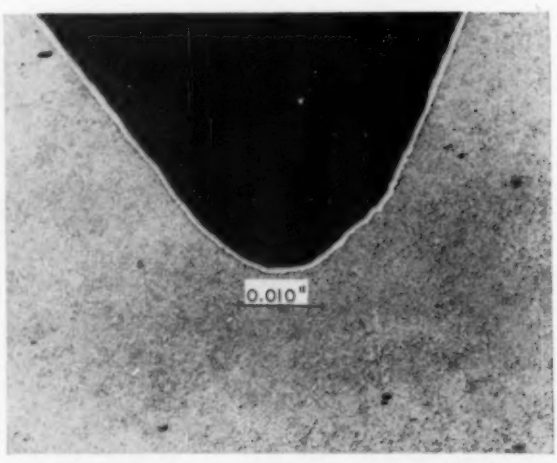


Fig. 6. Notch Root of Electroless Nickel Plated Specimen—two per cent Nital Etched—This photomicrograph shows the uniform coating of the notch root of an 4340–1.5 Si specimen having K_t = 3.2 (Notch radius 0.010 inches). This specimen has been plated with 0.001 inches of citrate electroless nickel. Note the uniformly tempered martensitic structure of the basis metal.

1. Anodic Cleaning

Hot electrolytic alkaline cleaning (anodic at 40ASF) was used to assure a clean, oil-free metal surface.

2. Anodic Etching[8]

An acid etch was used to remove light scale and to activate the steel for plating:

Sulfuric Acid	32% by volume
Magnesium Sulfate	Saturated
Temperature	45F
Current Density (Anodic)	50ASF

3. Plating

a. Three cadmium plating baths were evaluated:

	H.E. (High Efficiency) Cadmium	H.E. Bright Cadmium	Standard Bright Cadmium
Cadmium Metal (oz/gal)	7	7	3.5
Total Sodium Cyanide (oz/gal)	24	24	16
Sodium Hydroxide (oz/gal)	5	5	2.5
Sodium Carbonate (oz/gal)	3	3	3
Proprietary Brightener (Volume %)	—	1.4	1.4
Temperature	Room	Room	Room
Current Density (ASF)	20 or 40	20	30

b. One hard chromium plating bath was evaluated:

Chromic Acid	34 oz/gal
Sulfuric Acid	0.34 oz/gal
Temperature	135F
Current Density	300 ASF

c. Three electroless nickel plating baths were evaluated:[9]

	Alkaline Bath	Citrate Bath	Glycolate Bath
Nickel Chloride (oz/gal)	4	—	4
Nickel Sulfate (oz/gal)	—	5	—
Sodium Citrate (oz/gal)	13	4.5	—
Glycolic Acid (oz/gal)	—	—	3.3
Ammonium Chloride (oz/gal)	7	—	—
Sodium Hypophosphite (oz/gal)	1.3	1.7	1.3
*p*H/Control	9/NH_4OH	4.5/NaOH	4.5/NaOH
Temperature	195F	202F	202F

4. Baking

Specimens were baked to promote hydrogen outgassing and to uniformly distribute that hydrogen remaining entrapped in the steel. Post-plate baking was accomplished at 375F or at 550F using forced-circulation atmosphere furnaces certified accurate to ± 25F.

5. Passivating

Some of the cadmium plated specimens were given a corrosion resistant conversion coating.

Sodium Dichromate	27 oz/gal
Sulfuric Acid	1⅓ fl oz/gal
Nacconol NR	0.1 oz/gal
Temperature	Room

The plating thickness was measured on the specimen shank and was controlled to: 0.0005 inches thick for cadmium, 0.002 inches thick for chromium and 0.001 inches thick for electroless nickel. Plated specimens were examined under a wide-field microscope for complete notch-root coverage and for freedom from pits and blisters. After stressing, specimens were scraped with a knife to determine adhesion and metallographically examined to evaluate the plating of the notch root (Figs. 2 and 6).

DEVELOPMENT OF A LOW EMBRITTLEMENT CADMIUM PLATING PROCESS

During the electroplating process, both cadmium and hydrogen are cathodically discharged upon the basis metal. An increase in the current efficiency (with respect to cadmium) will result in a decrease in hydrogen pick-up during plating and should, therefore, result in an increased static fatigue life for the plated steel. Using this approach, a study was undertaken to determine the factors effecting the current efficiency of the cadmium cyanide plating bath. (The theory and methods for determining current efficiency are the subject of a forthcoming paper and will not be discussed here.) This study proved the cadmium content of the solution to have the most significant effect upon current efficiency—increasing the cadmium metal content from 2.5 to 6 oz/gal increased the current efficiency from 75 to 98 per cent at 40 ASF. As a result of this study, two new "high efficiency" plating baths were developed. The current efficiencies of these and the conventional plating bath are: H. E. bright cadmium at 20 ASF = 99.5 per cent (91% at 40 ASF), H. E. cadmium at 20 ASF = 99.5 per cent (98% at 40 ASF), and standard bright cadmium at 30 ASF = 87 per cent.

In order to test the effects of current efficiency upon hydrogen embrittlement, specimens were prepared, cadmium plated, baked and stressed as previously described. The test results are summarized in Table III.

Comparison of Tests 1 and 5 and of Tests 2, 3, 6, 7 and 16 indicate that the use of a brightener in the cadmium plating bath promoted embrittlement. Inasmuch as the current efficiency of the H. E. bright cadmium bath was at least as great as that of the unbrightened bath at the notch root (i.e., the brightener increased the current efficiency in areas of extremely low current density), it was apparent that the porous deposit, obtained from the bath containing no brighteners, allowed hydrogen to diffuse outward freely during the baking process. Operation of the H. E. cadmium bath at a high current density, and for a correspondingly shorter plating time, resulted in decreased embrittlement (Tests 6 and 7). This decreased embrittlement was thought to be due to two factors: (a) the shorter cathodic charging (plating) time limited the hydrogen migration into the basis metal, and (b) the higher current density resulted in an increased porosity such that the cadmium deposit no longer presented a low-diffusion-coefficient barrier to the outgassing of hydrogen at elevated temperatures.

The magnesium sulfate-sulfuric acid etch, used in all cases except Test 2, did not significantly promote embrittlement.

TABLE III
EMBRITTLEMENT DURING CADMIUM PLATING

Test	No. of Spec.	Steel	Heat-Treat Level	Per Cent Si	K_t	Plating Bath	Bake	Load (Per Cent Notched UTS)	Lower Critical Stress (Per Cent)	Time/Failures at 75 Per Cent of Notched UTS
1	2	AMS 6427	220–240 KSI	0.30	3.2	H.E. Bright Cad.	23 Hr/375F	75	—	7 Hr/2 Failed
2	3	AISI 4340	260–280 KSI	0.21	3.2	H.E. Bright Cad. (no acid etch)	23 Hr/375F	75	—	33 Hr/3 Failed
3	4	AISI 4340	260–280 KSI	0.21	3.2	H.E. Bright Cad.	23 Hr/375F	75	—	26 Hr/4 Failed
4	2	4340–1.5 Si	270–300 KSI	1.64	3.2	H.E. Bright Cad.	23 Hr/375F	75	Above 75	600 Hr/0
5	4	AMS 6427	220–240 KSI	0.30	3.2	H.E. Cad (20ASF)	23 Hr/375F	75	Above 75	150 Hr/0
6	4	AISI 4340	260–280 KSI	0.21	3.2	H.E.Cad (20ASF)	23 Hr/375F	75	—	140 Hr/3Failed
7	16	AISI 4340	260–280 KSI	0.21	3.2	H.E. Cad (40ASF)	23 Hr/375F	75–90	Above 90	200 Hr/0
8*	8	AMS 6427	220–240 KSI	0.30	5.7	Std. Bright Cad.	8 Hr/375F	39–88	60	140 Hr/1 Failed
9	8	AMS 6407	220–240 KSI	0.62	5.7	Std. Bright Cad.	8 Hr/375F	35–94	83	190 Hr/0
10	8	AMS 6418	220–240 KSI	1.40	5.7	Std. Bright Cad.	8 Hr/375F	65–94	88	225 Hr/0
11	8	4340–1.5 Si	270–300 KSI	1.64	5.7	Std. Bright Cad.	8 Hr/375F	89–98	80 Est.	33 Hr/—
12	8	4340–1.5 Si	270–300 KSI	1.64	5.7	Std. Bright Cad.	23 Hr/375F	90–97	88 Est.	100 Hr/—
13	4	4340–1.5 Si	270–300 KSI	1.64	3.2	Std. Bright Cad.	23 Hr/375F	75	Above 75	450 Hr/0
14	2	4340–1.5 Si	270–300 KSI	1.64	3.2	Std. Bright Cad.	4 Hr/375F	75	—	100 Hr/2 Failed
15	2	4340–1.5 Si	270–300 KSI	1.64	3.2	Std. Bright Cad.	None	75	—	22 Hr/2 Failed
16*	10	AISI 4340	260–280 KSI	0.21	3.2	Std. Bright Cad.	8 Hr/375F	30–98	45	44 Hr/6 Failed
17	4	AISI 4340	260–280 KSI	0.21	3.2	Passivated (See Text)		75	Above 75	190 Hr/0

*See Fig. 5

This was thought to be due to two factors: (a) the anodic charge on the parts was greater than the hydrogen potential of the solution, and (b) the low temperature of the solution resulted in a decreased ion mobility such that no appreciable acid reaction occurred between the time the current was disconnected and the time the parts were rinsed.

The order of increasing resistance of the steels to hydrogen embrittlement proved to be: AISI 4340 (260–280 KSI), AMS 6427 (220–240 KSI), 4340-1.5 Si (270–300 KSI), AMS 6407 (220–240 KSI), AMS 6418 (220–240 KSI). Increasing the baking time to 23 hours at 375F increased the resistance of the 4340–1.5 Si steel until it was comparable to that of the AMS 6418 steel (Tests 10, 11 and 12).

The high silicon steels were much less susceptible to hydrogen embrittlement than the low-silicon steel when heat treated to the same strength level (Tests 8, 9 and 10). In this series of related steels, silicon content had a more pronounced effect upon hydrogen embrittlement than did the carbon content or the heat treat level of the steels. A silicon content of somewhat over 1.5 per cent was sufficient to allow conventional cadmium plating of steel heat treated to the 270–300 KSI strength range. It was thought that the increased silicon content of the steel had reduced the diffusion coefficient of hydrogen in that steel. This would explain the superior response to the post-plate baking (outgassing) and the increased static fatigue life of plated high-silicon steels.

The embrittling effects of chromic acid passivation were evaluated using the most sensitive of the five steels (AISI 4340 steel heat-treated to the 260–280 KSI level). Specimens were prepared, H. E. cadmium plated at 40 ASF, baked 23 hours at 375F, hot alkaline soak-cleaned, rinsed, soaked 20 seconds in the Passivating solution, allowed to drain 10 seconds, rinsed, dried, aged 7 days at room temperature, and stressed (Test 17). The use of a post-bake passivating treatment did not result in any detectably increased embrittlement—in spite of the fact that the Passivating solution was highly acid and would normally be expected to introduce considerable hydrogen into the steel. The primary factor in the successful application of this treatment was thought to be the low diffusion coefficient of hydrogen in cadmium at room temperature.

EVALUATION OF HARD CHROMIUM AND ELECTROLESS NICKEL PLATING

In order to test the effects of chromium and electroless nickel plating upon hydrogen embrittlement, specimens were prepared, plated, baked and stressed as previously described. The test results are summarized in Table IV.

Hard chromium plating of AMS 6427 steel heat-treated to 220–240 KSI and AISI 4340 steel heat treated to 260–280 KSI resulted in detectable embrittlement. The degree of this embrittlement was dependent upon the baking time—a 23-hour bake at 375F resulting in embrittlement detected only at stresses in excess of 90 per cent of the notched UTS (K_t = 3.2). Hard chromium plating of 4340-1.5 Si steel heat-treated to 270–300 KSI which had received a three-hour post-plate bake at 550F resulted in embrittlement detectable only at higher stress levels using sharp notched specimens (K_t = 5.7). The following considerations effected the choice of the 550F baking temperature:

a. The post-plate bake could serve as an additional heat-treat temper.
b. Hydrogen outgassing would be more complete at a higher temperature.
c. The dynamic fatigue life of chromium plated parts baked at 550F should be comparable or superior to that of parts baked at 375F.

TABLE IV

EMBRITTLEMENT DURING CHROMIUM AND ELECTROLESS NICKEL PLATING

Test	No. of Spec.	Steel	Heat-Treat Level	K_t	Plating Bath	Bake	Load (Per Cent Notched UTS)	Lower Critical Stress (Per Cent)	Time/Failures at 75 Per Cent of Notched UTS
18	8	AISI 4340	260–280 KSI	3.2	Hard Chromium	8 Hr/375F	75	—	125 Hr/3 Failed
19	9	AISI 4340	260–280 KSI	3.2	Hard Chromium	23 Hr/375F	75–95	88	170 Hr/0
20	8	AMS 6427	220–240 KSI	3.2	Hard Chromium	23 Hr/375F	75–90	88	190 Hr/0
21	7	4340–1.5 Si	270–300 KSI	3.2	Hard Chromium	3 Hr/550F	75–95	Above 95	190 Hr/0
22	8	4340–1.5 Si	270–300 KSI	5.7	Hard Chromium	8 Hr/550F	94–99	92 Est.	420 Hr/—
23	4	AISI 4340	260–280 KSI	3.2	Citrate El. Nickel	23 Hr/375F	75	Above 75	170 Hr/0
24	5	AISI 4340	260–280 KSI	3.2	Alkaline El. Nickel	None	75	—	1.3 Hr/5 Failed
25	6	AISI 4340	260–280 KSI	3.2	Glycolate El. Nickel	23 Hr/375F	75–90	88	250 Hr/0
26	7	4340–1.5 Si	270–300 KSI	3.2	Glycolate El. Nickel	3 Hr/550F	75–95	Above 95	200 Hr/0
27	7	4340–1.5 Si	270–300 KSI	3.2	Citrate El. Nickel	3 Hr/550F	75–95	Above 95	340 Hr/0
28	8	4340–1.5 Si	270–300 KSI	5.7	Glycolate El. Nickel	8 Hr/550F	92–96	93	250 Hr/—
29	8	4340–1.5 Si	270–300 KSI	5.7	Glycolate El. Nickel	3 Hr/375F	88–95	92	310 Hr/—

Electroless nickel plating of AISI 4340 steel heat-treated to 260–280 KSI resulted in embrittlement detectable only at applied stresses in excess of 90 per cent of the notched UTS ($K_t = 3.2$). The lower critical stress for acid (and, presumably, for alkaline) electroless nickel appeared to about 90 per cent for parts baked 23 hours at 375F. Electroless nickel plating of 4340-1.5 Si steel heat-treated to 270–300 KSI which had received a three-hour post-plate bake at 550F resulted in embrittlement detectable only at higher stresses using sharp notched specimens ($K_t = 5.7$). The 550F post-plate bake temperature was chosen because of its effects on heat-treat temper, outgassing, dynamic fatigue life, and because it would increase the surface hardness of the electroless nickel coating.

CONCLUSIONS

The direct conclusions drawn from this investigation are summarized below:

1. The static notched tensile test is the most sensitive test for determining hydrogen embrittlement. For most purposes, this is also an appropriate method for evaluating the susceptibility of a plated steel to delayed fracture in service. The notch makes the specimen more sensitive and simulates the stress-raisers which occur in bolts and in other highly stressed parts.
2. The magnesium sulfate-sulfuric acid etch is a satisfactory low-embrittlement pickle for plating.
3. The presence of brighteners in cadmium cyanide plating baths promotes hydrogen embrittlement.
4. H. E. cadmium is a satisfactory low-embrittlement plating process when operated at current densities above 40 ASF and followed by a 23-hour bake at 375F.
5. The passivating bath may be used to improve the corrosion resistance of cadmium plate (deposited and baked using a suitable low-embrittlement process)without further embrittling the basis steel.
6. Chromium and electroless nickel are satisfactory low-embrittlement plating processes when followed by a suitable bake.
7. High-silicon steels are much more resistant to hydrogen embrittlement than are low-silicon steels when heat-treated to the same strength level.

ACKNOWLEDGMENTS

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William L. Cotton was born in Seattle, Washington in 1930. He received his BS degree in 1953 at Seattle Pacific College, where he majored in chemistry and mathmatics. He joined Boeing Airplane Company in 1953 and has served as a research chemist in the fields of cleaning, stripping, paint development, plating, hydrogen embrittlement, and chemical milling. Mr. Cotton is a member of the Seattle-Puget Sound Branch of the AES.

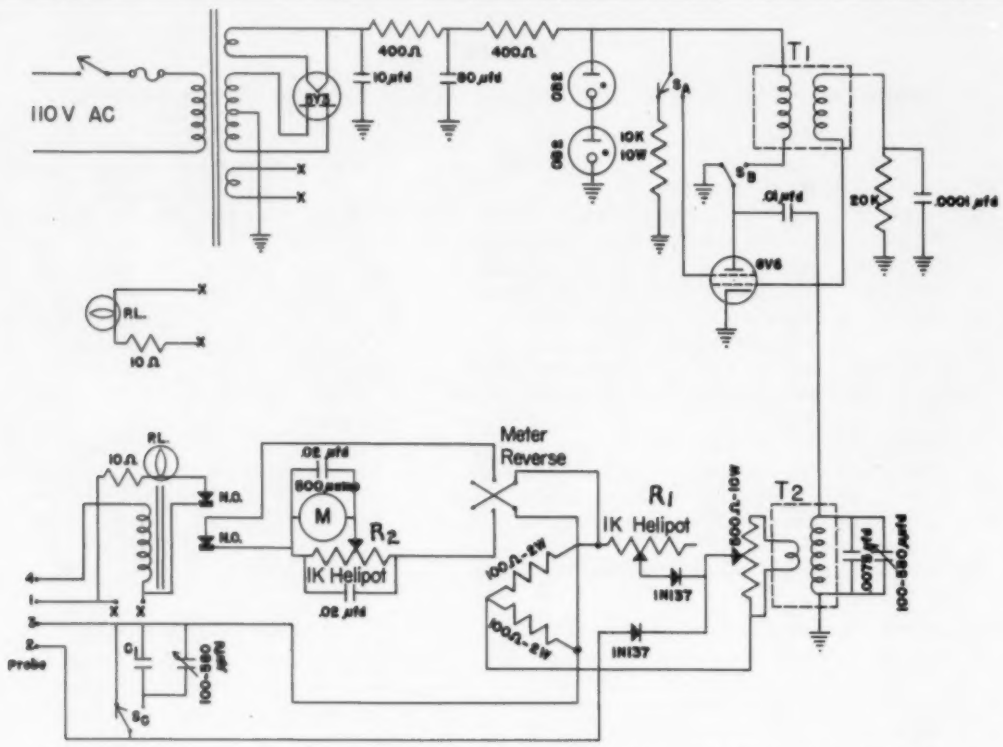

Fig. 1. Modified "Dermitron" circuit used for gages for measuring the thickness of chromium in steel tube bores. T_1, T_2: 100 kc output transformers.

GAGES FOR MEASURING THE THICKNESS OF CHROMIUM ON THE INTERNAL SURFACE OF SMALL-BORE TUBES

by VERNON A. LAMB and PAUL A. KRASLEY*

Two gages of the eddy-current type for measuring the thickness of chromium coatings on the internal surface of caliber .30 and caliber .50 gun barrels have been developed. Measurements are nondestructive and are localized to a small area, less than ⅛ inch diameter. The gages may readily be modified to be generally applicable to the measurement of the thickness of various coatings on the internal surfaces of metallic tubes of the same or larger diameters.

1. INTRODUCTION

Chromium plating of the bores of gun barrels has been shown to produce significant increases in the firing life of the barrels. This process has been extensively applied to military weapons, both small caliber and cannon.[1, 2] Performance of a plated barrel will be inferior if the plate is too thin. The average thickness of the plate in a barrel can be measured in terms of the difference in diameter of the bore before and after plating, but such measurements do not disclose circumferential non-uniformity of thickness. The measurement of local thickness of the plate in a gun bore is therefore important. For purposes of production control, it is desirable that such measurements be easily made by a nondestructive method.

Some work on gages for this purpose was done prior to the present work. A Magne-gage of special design was made for measuring the thickness of chromium plate in cannon of 3-inch caliber and larger.† An electrical gage based on an inductance effect is known to have been under development for the same purpose at the Armament Research Establishment, Woolwich, England. These gages are not readily adaptable to miniaturization for use in small bores. A standard Magne-gage was modified by one of the authors to adapt it for measuring the local thickness of chromium in caliber .50 barrels for a distance of about 6 inches from either end. This gage was not suitable for plant use. None of these special gages has been described in publications.

The gages described here were designed to fill the need for production inspection instruments capable of measuring the local thickness of chromium plate in the bore of small arms barrels. They are described in the belief that useful applications may be found in the measurement and control of the thickness of chromium or other coatings in the bores of small tubes other than gun bores, since considerable amounts of metal tubing are today being plated internally for various process applications.

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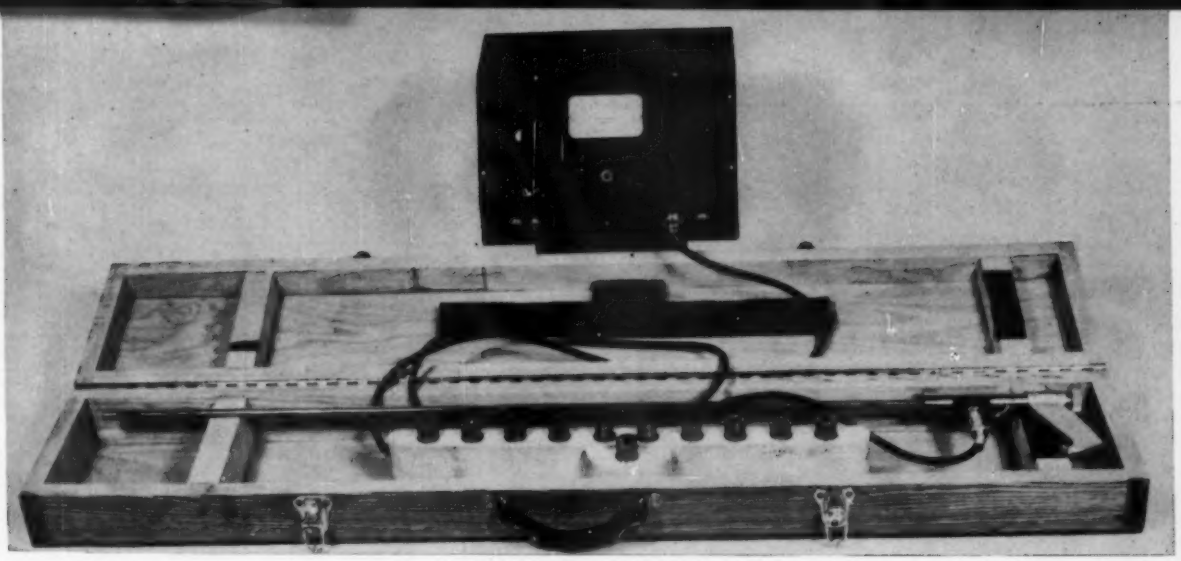


Fig. 2. Complete caliber .50 gage.

2. PRINCIPLE OF OPERATION

Several types of gages were considered, including magnetic, reluctance, and eddy-current types. An eddy-current type based on the "Dermitron" gage recently described by Brenner and coworkers[2] was selected for adaptation to the present purpose. In this gage an alternating current in a probe coil induces an eddy current in the coating. Use of a high-frequency current limits the eddy current to a thin surface layer (skin effect). The frequency is so chosen that the eddy current penetrates the coating. Therefore, if the coating and the basis metal have different conductivities, the magnitude of the induced eddy current will depend on the thickness of the coating. The induced eddy current is measured indirectly through the effect of its magnetic field, which opposes that of the inducing current. The opposition of the two fields lowers the impedance of the probe coil. The latter is measured with the bridge circuit shown in Fig. 1. In practice it is not necessary to determine the actual impedance of the probe coil. Rather, the degree of unbalance of the bridge is measured with the microammeter M (Fig. 1), the readings of which are calibrated in terms of thickness with suitable standards.

3. DESCRIPTION OF THE GAGES

3.1 Electrical circuit

The circuit shown in Fig. 1 is similar to that described by Brenner and Brodell,[3] but is simpler in that only one frequency is provided (100 kc), since this is sufficient for measurements of the single coating system concerned, namely chromium on steel. The major sections of the circuit are the power supply, oscillator, and bridge, which are contained in the cabinet shown in Fig. 2.

3.2 Probe coil

The design of the probe coil is one of the important features of this development. Since the lands in the gun barrels are only about 0.06 inch wide, the field from the coil should be limited to a diameter approaching this value. Furthermore, in order to fit into the limited space available in the bore of the barrel, the dimensions of the coil are limited to a maximum diameter of about ⅛ inch and length of 0.15 to 0.20 inch. Within these limits, a number of coil forms were made with various ratios of diameter to length, and were wound with several sizes and numbers of turns of wire. Coils with polystyrene cores and with ferrite cores and shields were tried. These experiments led to the design shown in Fig. 3. Within the limitations stated above, it is believed that this design is nearly optimum.*

The coil must be mounted on a non-metallic holder. If the holder were metal, eddy currents induced in it would reduce the sensitivity of the measurements. Therefore, the block D, Fig. 4A, which supports the coil in the caliber .30 gage, is made of linen-filled Bakelite. In the caliber .50

* Unit Process Assemblies, Inc., 61 East 4th St., New York, N. Y., has been granted patent claims for probe element devices of the type described.

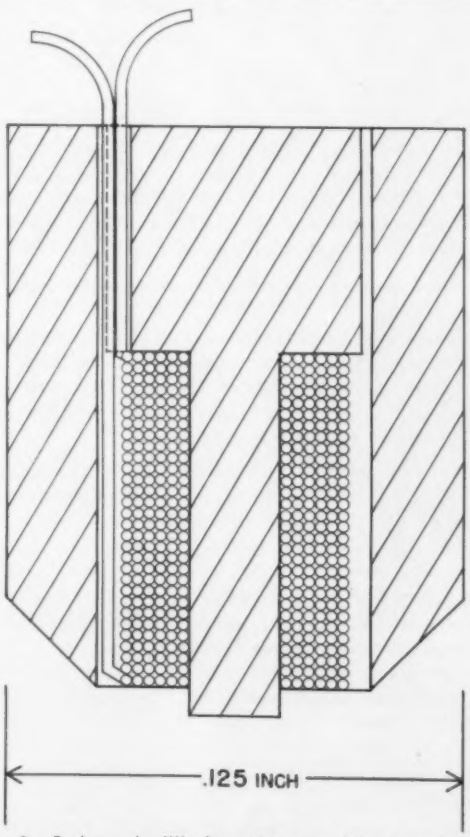
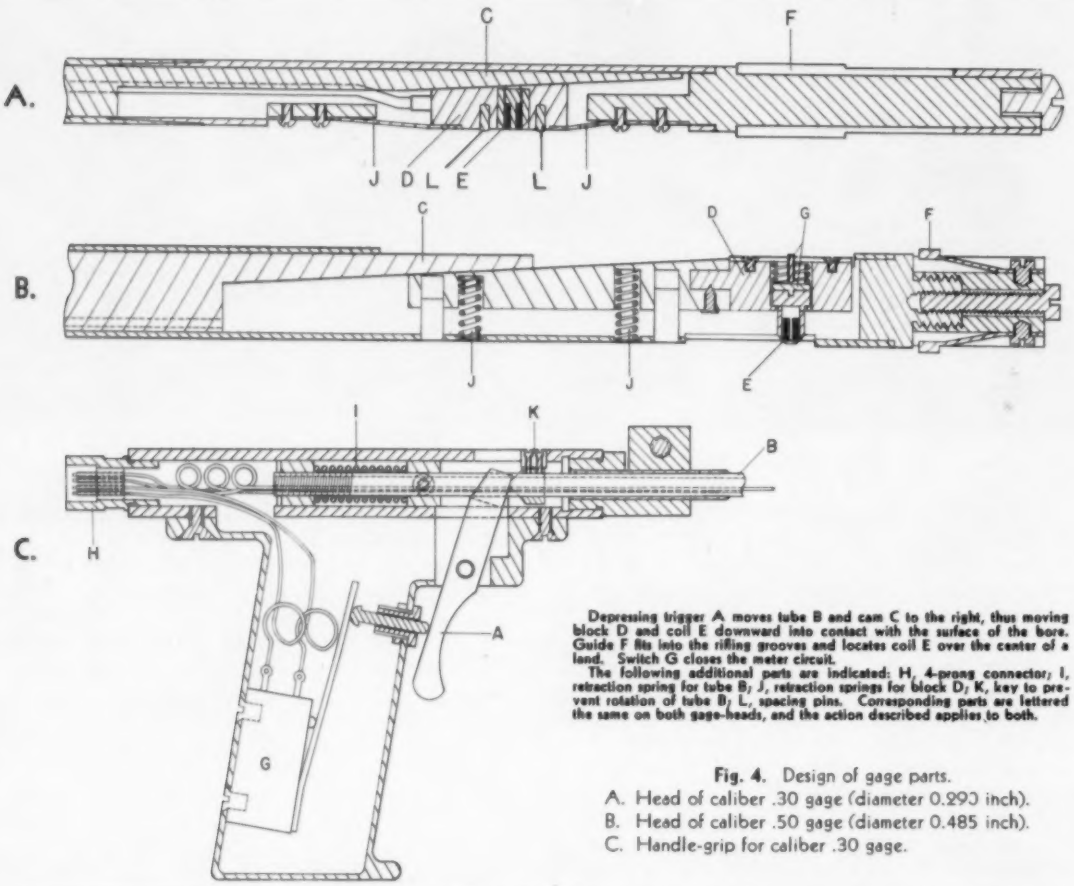


Fig. 3. Probe coil. Winding: 200 turns, No. 40 enameled wire. Core and shield: ferrite. Parts are cemented together with epoxy resin.



Depressing trigger A moves tube B and cam C to the right, thus moving block D and coil E downward into contact with the surface of the bore. Guide F fits into the rifling grooves and locates coil E over the center of a land. Switch G closes the meter circuit.

The following additional parts are indicated: H, 4-prong connector; I, retraction spring for tube B; J, retraction springs for block D; K, key to prevent rotation of tube B; L, spacing pins. Corresponding parts are lettered the same on both gage-heads, and the action described applies to both.

Fig. 4. Design of gage parts.
A. Head of caliber .30 gage (diameter 0.290 inch).
B. Head of caliber .50 gage (diameter 0.485 inch).
C. Handle-grip for caliber .30 gage.

gage (Fig. 4B), the block D is brass, but the piston to which the coil is cemented is made of Nylon. Other resin-type materials could be used in both cases.

3.3 Mechanical design

The design of the gages is shown in Fig. 4. The drawings and the accompanying legend present the main features of the construction and operation of the gages. Therefore, this section is limited to a brief explanation of the differences between the caliber .30 and caliber .50 models.

The handle grip for the caliber .30 gage (Fig. 4C) is similar to that for the caliber .50 gage. The latter is therefore not shown. The major differences are that the handle of the caliber .50 gage does not contain the switch (G), and the connector H is located ahead of the trigger (Fig. 2). Sections of the heads of both gages are shown in Fig. 4A and 4B. The switches G, which connect to points 1 and 4, Fig. 1, disconnect the microammeter when the probe is withdrawn from the surface of the bore, because under these conditions the bridge is very unbalanced, and therefore damage to the meter might occur if it were in the circuit. G is placed in the handle in the caliber .30 gage because the diameter of the head is not large enough to accommodate a switch of the type used in the caliber .50 gage.

The limited space in the head of the caliber .30 gage made it necessary to use leaf springs (J, Fig. 4A) instead of coil springs (J, Fig. 4B) to effect retraction of the probe block (D).

In both gages the tip of the probe core is about 5 mils from the surface of the bore when a reading is made. In the caliber .30 gage this spacing is determined by the relative location in the probe block of the coil and the hardened steel spacing pins L (Fig. 4A). In the caliber .50 gage this spacing is determined by a sapphire tip cemented to the end of the coil.

4. OPERATION OF THE GAGES

The gages are calibrated with thickness standards in the form of short segments of barrel, which are placed in turn in position over the head of the gage. Starting with an unplated barrel segment, the balance rheostat (R_1, Fig. 1) is adjusted to give a meter reading of zero. Then, with the thickest standard in place, the sensitivity rheostat (R_2, Fig. 1) is adjusted to give a meter reading near the top of the scale. Meter readings are then taken with specimens of intermediate thickness, and from these readings a calibration curve is constructed (Fig. 5). The meter reversing switch (Fig. 1) is provided to permit the use of the gage with combinations of coatings and basis metals other than chromium on steel.

Measurements of thickness in the bore of a barrel or tube are facilitated if a gaging bench is supplied. The gaging bench should be equipped with a traveling carriage, with supports for holding the tube in a horizontal position. The handle end of the gage should rest in a support that is adjustable vertically, to permit alignment of the gage with the bore of the tube.

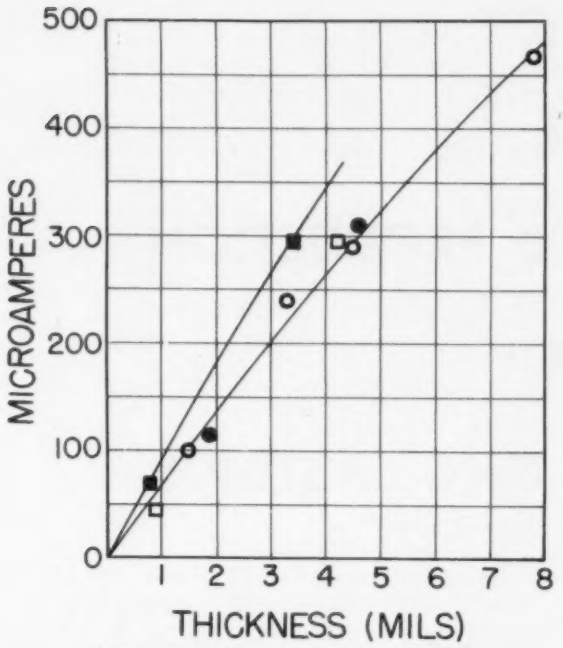


Fig. 5. Calibration curve for caliber .50 gage.

● = ordinary bright chromium from bath containing 250 g CrO_3 and 2.5 g H_2SO_4 per liter; c.d., 30 amp/dm², temp, 55C.
○ = ordinary bright chromium from same bath; c.d., 20 amp/dm²; temp, 50C.
■ = soft type chromium from same bath; c.d., 80 amp/dm²; temp, 85C.
□ = chromium from a proprietary self-regulating bath; c.d., 30 amp/dm²; temp, 55C.

5. EVALUATION OF THE PERFORMANCE OF THE GAGES

The accuracy and reproducibility of measurements made with these gages depend on several variables. Some of these are fixed by the design and should remain constant, such as the distance between the tip of the probe coil and the surface of the bore. However, excessive pressure on the trigger may change this distance and also distort the coil, with a resultant spurious reading. Fluctuations in line voltage affect the readings. A constant-voltage transformer between the power line and the oscillator is therefore desirable.

Variations in properties of the basis steel may cause significant error. The readings of the microammeter for several specimens of unplated gun steels from different heats (types SAE 4150 and 4340) varied within a range of 10 microamperes, which corresponds to an error of about 14 per cent in thickness at 1 mil, or 3 per cent at 5 mils. This error can be approximately compensated by applying a correction to the meter reading equal to the difference between the zero reading for the unknown steel and that for the steel of the standard thickness specimens.

The experimental points plotted in Fig. 5 were obtained with the caliber .50 gage. They show that, within the limits of accuracy with which the thickness was determined on the standard specimens, the response of the gage is the same for three different bright types of chromium plate. The upper curve shows, however, that the sensitivity of the gage is significantly higher for chromium plate deposited under conditions of high bath temperature and current density. This result is in accord with the relative resistivities that have been reported for these different types of chromium plate.[4]

The effect of curvature of the internal surface of the bore was found to be significant. The sensitivity (microampere per mil) of the caliber .50 gage is 10 to 20 per cent higher for measurements on a flat plate than on the surface of the bore.

Measurements made with the coil of Fig. 3 are localized to a very small area. This was shown by taking successive readings approaching the edge of a uniformly plated panel. The readings were constant until the center of the coil was about 0.04 inch from the edge of the panel.

The maximum thickness range of these gages was not determined. However, the fact that the calibration curve is nearly linear up to a thickness of about 8 mils indicates that considerably higher thicknesses, probably up to 15 or 20 mils, could be measured.

Gage readings taken by two different observers agreed within ±5 per cent for thicknesses less than 2 mils and within ±3 per cent for thicknesses greater than 3 mils. The accuracy of the values shown in Fig. 5 for the thickness of the plate in the standard thickness specimens is ±10 per cent. The thickness of the plate in smooth-bore standards could be determined more easily and accurately than that in rifled tubes.

6. ACKNOWLEDGMENTS

Acknowledgement is made to Messrs. Connie L. Stanley and W. H. Metzger Jr., who prepared the thickness standards; to Virginia D. Hill for assistance in measuring the thickness of the plate in the standards; to Abner Brenner for helpful advice; to personnel of the NBS Instrument and Electronic Shops; and to Springfield Armory for financial support of this project and for permission to publish a description of the gages.

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THE METALLURGY AND PRODUCTION OF ALUMINUM AND ZINC CASTINGS

by DONALD L. LA VELLE*

Mr. LaVelle appeared before the AES Bridgeport Branch at Bridgeport, Connecticut on September 11, 1959. As he did not present a prepared paper the presentation, in the form of a question-and-answer session, was tape recorded. A transcript revealed that the questions and answers contained timely and valuable information on castings and the difficulties platers may encounter.

MR. LAVELLE: In this discussion I would like to better acquaint you with castings in aluminum alloys and zinc alloys, the methods of making castings, the defects present in castings, and, finally, how these defects, alloys, and casting methods affect anodizing and plating.

The subject is aluminum and zinc. Let us start with zinc because it will be the shorter topic of the two. The only castings in zinc we will be concerned with are zinc die castings.

Zinc die castings are produced only in two alloys today, and, even so, one alloy far outstrips the other in quantity. In handling zinc castings, we are not basically concerned with the alloy content because the two alloys in common use are very similar. Alloy number 3 has 4 per cent aluminum, 0.04 per cent magnesium. Alloy number 5 has 4 per cent aluminum, 0.04 magnesium and 1 per cent copper.

This is a simple alloy system and both alloys act entirely alike as far as electroplaters are concerned. The only differences between these two alloys is a slight difference in mechanical properties and a slight difference in dimensional stability, but as far as the reaction to plating and finishing, the alloys are exactly alike.

Q: Is number 2 similar to number 5?

A: Number 2 is an older alloy which contains even more copper and it is falling into disuse because it is rather unstable dimensionally. In other words, these zinc alloys are peculiar in that shortly after casting they shrink and then, after approximately several months, they grow back a little and end up being smaller than they were at the beginning. The higher the copper, the more this dimensional instability. The higher copper was formerly used because it had a slightly higher Brinell and a little bit higher tensile strength, but I think there is hardly any Number 2 used today, mostly 3 and 5.

Q: Have any problems associated with the plating of die castings been associated with the shrinkage after casting?

A: Not that I have ever heard.

Q: What is the percentage of shrinkage of 3 and 5?

A: Shrinkage? Do you mean dimensional change?

Q: That's right.

A: The final net change is on the order of 0.0006 in./in., but before it arrives at that, it first shrinks and then grows.

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In precise instrumentation or castings that are machined to close tolerances, this can be difficult to handle.

ALUMINUM ALLOYS

Let's go on to aluminum alloys. I want to cover all casting methods and review the aluminum alloys in common use for all casting methods.

The three most common alloying ingredients are copper, silicon and magnesium.

The first most common ingredient is copper; and there is a series of alloys all containing 4 per cent copper. They are referred to by the so-called Commercial Numbering System:

Number	
195	4 copper, 1 silicon
108	4 copper, 3 silicon
A108	4 copper, 5 silicon
319	4 copper, 6 silicon
380	4 copper, 8 silicon
384	4 copper, 11 silicon

The alloys in this series, all with zero magnesium, are of the same basic type—varying only in the amount of silicon.

There is another series of alloys in which silicon is the principal ingredient. Number 43 is 5 silicon. A common die casting alloy known as 360 is 9 silicon and 0.5 magnesium. Then there is 13 which is 12 per cent silicon.

These are the basic aluminum alloys with which platers deal. There are more die castings produced in 380 alloy than all the rest put together, because this alloy has the best compromise of all properties and cost.

Every single aluminum alloy is a compromise. If one property is desired more than some other property, the others must be sacrificed to gain that one. This 380 alloy has the best combination of price, castability and machinability, and that is why it is the most widely used for die castings.

In sand castings probably 319 is the most widely used today for the same reason. In permanent mold, a rather larger variety of alloys are in wide use. It would be difficult to pick one alloy and say this is the alloy that's most used in permanent mold because each type of use has its favorite alloy. For instance, for cookware in permanent mold, it is almost exclusively 43; for high-strength heat-treated alloys, we have 356, which is zero copper, 7 silicon, 0.3 magnesium. The latter is one of the most common, heat treatable sand and permanent mold casting alloys. Number 355—1 copper, 5 silicon, 0.5 magnesium—is another high-strength heat-treatable alloy in wide use.

Q: Which alloy is going to be used for the motors in some of the new cars?

A: It depends on whether they will be permanent mold cast or die cast. One manufacturer is experimenting with a die cast block of the 4 copper, 11 silicon alloy. Another well known make is permanent mold cast in 356.

Q: Would that be porous?

A: We will get to that later.

There are twice as many more alloys as have been mentioned, which are for special purposes.

Q: I don't know about the other people, but I find it quite difficult to associate these identifications with the constituents, and I was trying to get an association with respect to the identification of the alloy and its ingredients. I couldn't.

A: The industry is still saddled with these old numbers which originated with the aluminum industry and mean nothing to anybody not working with them every day.

The ASTM has a logical alloy identification system which has been in use for several years. In the ASTM system, an alloy that contains 4 copper, 8 silicon and 0 magnesium, which is commercial 380, ASTM would call SC84—silicon 8, copper 4. A good system that works out very nicely.

Number 356 is ASTM SG70. It just happens that "G" stands for magnesium, but it's a good system and is workable and understandable, and we have hopes that the ASTM system will be incorporated into the Federal specifications someday and maybe even by the Aluminum Association; and then perhaps we can get rid of these meaningless numbers.

Q: What makes 356 best for heat treatment?

A: It is not necessarily best for heat treating, but it happens to be one of the most castable alloys for sand and permanent mold. It is very fluid, relatively free of shrinkage, and heat treatable. That accounts for its wide use. There are many other heat-treatable alloys.

Two major factors make alloys heat treatable: one is 4 per cent copper and the other is a combination of silicon and magnesium. Almost any alloy that has silicon and magnesium in it or 4 copper is heat treatable.

Two other classes of alloys should be mentioned. One has magnesium as the principal ingredient. Number 214 is 4 per cent, 218 is 8 per cent and 220 is 10 per cent. Numbers 214 and 220 are sand cast alloys. Number 218 is die cast.

Another series of alloys has zinc as the major ingredient and most of these alloys are known by trade names. There are about six major alloys in this field. One named Tenzaloy has 8 zinc, and about 0.4 magnesium. These alloys are most commonly sand cast. You won't find them in die castings, and only rarely in permanent mold. They have the property of self-aging at room temperature to give high strength without heat-treatment.

Q: Do you use any of those alloys in extrusions?

A: No, not exactly. You will find extrusions with manganese, combinations of copper and magnesium, zinc and magnesium and small amounts of silicon and magnesium.

On casting processes, we have sand, permanent mold, and die castings—the three basic types.

In sand, there are what are known as green sand, core sand, and shell molds.

Permanent mold is simple: It is always in iron mold.

Die castings are in alloy steel molds. In addition, there are a number of very specialized casting methods—plaster and investment, and some others which we won't mention.

Sand means just what it says. The castings are poured in sand. Green sand means unbaked, as compared to core sand which is baked. The sand is a silica sand containing about 5 per cent clay, which the foundryman mixes with about 5 per cent of water to make it moldable. He makes the mold, takes out the pattern, and pours in the metal to make a green sand casting.

Core sands are baked. Silica sand is mixed with certain types of oils which, when heated at 450°, oxidize and harden to make a hard shape out of the sand which can be easily handled. Cores usually form the interior part of a green sand casting.

Shell molding is a relatively new process, only about five years old. Silica sand is mixed with a resin, a plastic resin. A metal pattern is heated up quite hot, put over a box of sand, and the box turned over. The sand falls off except for about an eighth of an inch thick layer which adhered to the

hot pattern. Then, the pattern plus the adhering sand is placed in an oven. It is baked for a few minutes, hardening the resin, and then the hardened sand can be stripped off leaving what is called a shell, which is a duplicate of the pattern.

Two of these shells are put together and the casting poured.

This process permits good dimensional control and produces, in general, a smoother surface than ordinary green sand.

Permanent molds are machined from cast iron and it is just what it is called—a permanent mold. It is a cavity which can be opened and closed; and when closed, the metal is poured down the top, fills the cavity and when solidified the mold is opened to remove the casting.

Die casting is basically the same as permanent molding except that the metal is forced in under very high pressure, at very high speed.

Plaster is exactly that. It is plaster of Paris. A pattern is put in a box, liquid plaster is poured around it. It hardens. The pattern is removed. The plaster is baked in an oven and when it is dry, the metal is poured into it.

Investment casting is practically the same as plaster, but it is quite a bit more complicated.

It is first necessary to make a steel die. Say this chalk is the casting to be made. A steel die is made with a cavity that is the size and shape of the chalk. Wax is injected into the cavity and when the wax piece is removed it looks just like the chalk. Then many of these wax pieces are assembled in a tree. The assembly is put in a box and the investment poured around the wax. This investment is like plaster of Paris only it is a lot more refractory. The investment is put into an oven and fired at a high temperature, above red heat, and while it is being fired the wax melts and runs out leaving behind a hole that looks like the chalk. Then the fired investment is taken from the oven, cooled, and the metal is poured in the hole.

The reason for going to all this trouble is to obtain fine reproduction of detail, close dimensional tolerance and smooth surfaces. It is used almost exclusively for very small castings. Investment castings are rarely more than a few inches in size

CASTING DEFECTS

Now, let's talk about what's wrong with castings. This is where I think the whole purpose of the talk comes in because I want to tell you about the defects in castings that cause rejects in plating or anodizing, and why they are there and how they occur.

There are a few basic categories for what is wrong with castings. The two main types are porosity and inclusions. There are various kinds of porosity: shrinkage, trapped air and gas.

What is shrinkage?

Almost every metal when changing from a liquid to a solid will decrease in volume. Aluminum alloys for instance, will decrease about 5 per cent. That means if you pour one hundred cubic inches of metal into a mold, when it freezes, you have 95 cubic inches of casting. That's quite a volume change.

Shrinkage can make itself apparent in a number of ways. The casting may have spongy depressions in the surface, or it may have porosity in the interior.

The sand foundrymen and the permanent mold foundrymen endeavor in their gating and risering systems to chase this shrinkage out of the casting into the riser by controlling the solidification. This is known as "directional solidification."

For example, with a small, simple chunkey shape like a cube, a large metal chill is placed on the bottom and a large riser on the top. When filled with metal, freezing will start on the chill and will progress through the casting toward the riser. As each layer of metal freezes, the shrinkage will be fed by the liquid above. If this process works ideally all the shrinkage will end up in the riser and the casting will be sound. However, it is unlikely that a casting 100 per cent free of shrinkage has ever been made. That would be almost impossible to attain.

Zinc alloys shrink about 4 per cent. Most copper base alloys shrink between 4 and 7 per cent. All of them about the same. Aluminum alloy shrinkage varies directly with the silicon content. The foundrymen like high silicon alloys because they shrink less. For instance, pure aluminum shrinks around 6.3 per cent. The 12 per cent silicon alloy mentioned earlier only shrinks 3.6 per cent. So, naturally, the sand foundrymen, permanent mold and die casters all like high silicon because of the decreased shrinkage.

Q: Over what period of time would this dimensional change take place?

A: During solidification, while the metal is freezing from the liquid to the solid.

Q: In other words, when the plater gets it, it's already preshrunk, so to speak, it doesn't shrink any more?

A: That is correct, but this is a different subject than dimensional stability. This is liquid to solid. Once the metal is solid, it is all over.

Q: How much is it possible to correct this by over-sizing the pattern?

A: The pattern can be made bigger to compensate for shrinkage, but this is almost never done because shrinkage is impossible to predict. If it was possible to make a casting with perfect directional solidification so that the shrinkage all ended up in the riser, then the casting would be exactly the same size as the pattern. What the pattern maker tries to compensate for is the change in size from the solidification point down to room temperature.

There are three phases to the dimensional change that occurs in making castings. Fill a cylinder with liquid aluminum —first the metal has to be hotter than the melting point or it could not be poured. It shrinks in cooling to the point where it starts to freeze. Then it freezes and shrinks to a solid. This is the liquid to solid volume change. At this point the temperature is almost 1000F, and when cooling down to room temperature, it shrinks again. This is the co-efficient of thermal expansion or contraction.

The pattern maker usually is only concerned with this portion, the dimensional change due to the lowering of temperature.

The second kind of porosity is trapped air. In aluminum alloys this is a very important consideration in sand castings and in die castings. It is almost non-existent in permanent mold. The reason why we have trapped air difficulties is 1) aluminum is a light alloy and therefore air bubbles do not come out of it quickly; and 2) aluminum has a very tenacious oxide skin and bubbles do not break easily. Once an air bubble is formed in aluminum, it tends to stay there. It doesn't easily rise to the top and break as in water.

Some sand foundrymen are notably lax in their pouring practice. There is a hole in the mold called a sprue into which the metal is poured and most sand foundrymen do not pay any attention to how the metal goes down that hole when, actually, it is a very important operation. It is nearly as important as anything else they do. The metal should be

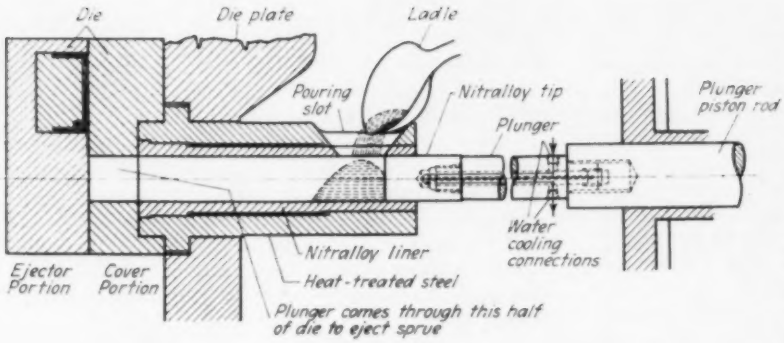


Fig. 1

put down the hole in as quiet and non-turbulent a manner as possible.

Q: Why haven't they considered the possibility, in respect to die casts, of evacuating the chamber?

A: They have. That's the hottest subject in die casting today.

Q: Is it worthwhile to put another opening, a second hole, in the casting to let the air out?

A: It will not come out. These bubbles stay in the metal and as the metal fills the mold, the bubbles will become trapped at the top, and do not break through. They flow along with the metal and come up just under the skin. When the casting comes out of the sand, it looks beautiful, nothing wrong with it. If the foundry happens to have sand-blasting machines and blasts the casting, it comes out full of holes. If it goes to the customer and he puts it on the polishing wheel or machines it, it is found to be full of holes.

Q: Before we get too far away from the subject, what is the nature of the lubricant used in aluminum mold?

A: In permanent mold casting, the walls of the cavity are coated with a refractory wash. It has two purposes: The first purpose is to protect the mold from the aluminum because aluminum has a high affinity for iron and will dissolve iron, so the molten aluminum must be kept away from the iron. The second reason is to control the solidification of the aluminum in the permanent mold. In the riser section and in the gate section there is a very thick wash, maybe a sixteenth of an inch thick. When it is desirable to have the casting solidify rapidly, the wash is smoothed off until it might be only a thousandth of an inch thick.

Now, in die casting, lubricants such as oil, kerosene, wax, aluminum powder are used—I don't know what they don't put in die lubricants.

Q: Silicones?

A: If you were to ask me what is the best die casting lubricant to use, I could not tell you because every single die caster will give a different answer.

Q: These are the big problems in plating?

A: That is correct, and maybe we can explain that a little more fully when we get to talk about die casting in more detail.

Q: They are using silicone oils now.

A: There is a rather substantial majority of the die casters who do not like silicone lubricants. They do not seem to work in aluminum die casting.

For instance, on shell molding, when the shell has to be lifted off the pattern, the silicone lubricants have worked very well as a parting agent.

Trapped air is extremely prevalent in die castings. This is a good time to detail a little bit about what die casting is anyway.

In Fig. 1 there are two halves of a die with the die cavity in the center. Usually at the bottom there is a very small, thin orifice called a gate, which is connected to a horizontal cylindrical called the shot chamber. At the end opposite the gate there is a piston connected to a hydraulic cylinder, and on top is an opening into which the metal is poured. To the right there is shown a pot of liquid aluminum. A ladle of metal is taken and poured in the hole. The metal lies in the bottom of the tube. The operator presses a button. The plunger goes in at high speed under as high as 1000 psi pressure and slams the metal up through the gate, filling up the casting, and that is a die casting. Metal is squirted in a thin stream at a high velocity into the open die chamber. It is filled up and squeezed real hard and called a casting, when it is really nothing but a shell full of air. Trapped air is the major source of porosity in die castings, both aluminum and zinc, it doesn't make any difference.

VACUUM DIE CASTING

Somebody mentioned vacuum or evacuated dies, so-called. Vacuum die casting is a hot subject today and what they do is, by various mechanical means, attach a vacuum line and pull air out of the die chamber before the metal gets in. There are many different ways that this has been done, but that is the basic premise. Unfortunately, the word "vacuum" is a misnomer. It should be called "reduced pressure die casting" because very few pull much of a vacuum. Very few get over 20 inches of mercury, and a full vacuum is 29.92 or 30 inches. Fifteen to 18 inches is more common, which is, you might say, only half a vacuum.

Let us assume that we are taking out the major portion of the air. This will make castings of high quality simply because there is no air in them to trap and the castings will be sounder and better. This system, you might say, is sweeping the zinc die casting business. A zinc die caster who does not have at least one vacuum machine in his shop today is out of date. Aluminum vacuum die casting is developing much more slowly because aluminum is much more difficult to engineer and it costs a lot more money, and the advantages are not quite as apparent as they are for zinc. Apparently the people using vacuum die casting in zinc have been able to make thinner castings, bigger castings and sounder castings than they were able to before. This is not quite as true in aluminum.

The third source of porosity in castings is gas. This is only applicable to sand and permanent mold. Gas is of no concern in die castings.

Now, to explain. The gas is hydrogen. Aluminum when it is a liquid is a solvent for hydrogen. It gets hydrogen from water vapor. It will take moisture out of the air, out of the products of combustion, or any place where water is available. Molten aluminum will reduce the water, making aluminum oxide and hydrogen, and the hydrogen is soluble in the aluminum, very much so. When the aluminum freezes or solidifies, this gas comes out of solution and forms small holes

often known as "pin-hole porosity." It is usually characterized by being uniformly distributed throughout the casting.

This is not true of shrinkage. Shrinkage is usually localized because the casting will freeze first in one place and last in another, and the place it freezes last is always where the shrinkage is, but gas is usually uniformly distributed. This is another way of distinguishing from the trapped air, which is highly localized. Another thing, the trapped air is always only on the top side of the casting, never on the other, whereas gas is all through the casting, everywhere, completely uniform,

This gas is troublesome in sand and permanent mold castings for plating, anodizing, polishing, machining, x-ray, everything. The gas is of no concern in die castings because in the first place die castings are made from aluminum poured just above its solidification temperature and the gas is practically insoluble at that temperature. Secondly, the solidification rate in the die is so rapid that if there were gas present, it would be so fine you could never see it. So gas in die castings is no problem.

Q: What about the investment castings and the plaster castings?

A: In plaster and investment casting, gas is a serious problem because the size of the gas holes is directly related to the speed of the freezing. The faster the rate of freezing, the smaller the hole. As mentioned about die casting, even if there was some gas, you could not see it. The slower the solidification, the larger the gas holes. If metal that would make large pin-holes in sand had been poured in a permanent mold, the porosity probably would have been so fine as to have been almost invisible. If that same metal had been cast in plaster or investment, the holes would have been bigger because the cooling is so slow.

Q: Are any fluxes usually used to keep the hydrogen from being absorbed?

A: No, I do not believe so. It is almost impossible to melt aluminum without having gas absorption, especially in fuel-fired furnaces. If you use electric melting like low-frequency induction, or resistance you can do a pretty fair job, but, even there, on a hot, humid summer day you still cannot take aluminum up to 1300 or 1400F without gas absorption because it takes hydrogen right out of the air. When there are products of combustion to contend with, the problem is much more difficult. Then the foundrymen concerned about producing castings with the minimum amount of gas has to resort to degassing procedures which are available and which are quite efficient when properly used. Castings can be made essentially free of gas.

Of course, another complicating factor is he is going to pour it in wet sand. You can have perfectly degassed aluminum, pour it in green sand mold, and obtain a gassey casting.

The second main category of casting defects is non-metallic inclusions or hard spots. In machining or polishing aluminum castings, hard spots are often encountered which will dull the edge of the cutting tool or, in polishing, cause streaks or rat tails in the surface. These are almost without exception oxides, Al_2O_3, MgO, ZnO. Do not let anybody kid you that these are chunks of silicon or chunks of something else. They are oxides.

Q: Isn't this what is very loosely and abusively termed "cold shut?"

A: No, not really. We will get to that. These are hard spots. They are actually chunks of foreign material in the casting.

Q: Are they always oxides? Aren't they sometimes intermetallic compounds?

A: Not in the sense they are considered here. These are oxides and this is what you make grinding wheels out of so it is pretty hard. It is the same as carborundum or emery. Aluminum oxide is very hard and will knock the edge off a carbide tool as if it were butter.

Such oxides are most commonly present in the castings because of poor practice on the part of the foundryman or die caster, sloppy practice, poor pouring practice, poor melting practice, poor handling somewhere in the shop is what causes hard spots to be present in castings.

Many foundrymen and die casters often believe that these hard spots are silicon, but this is not the case. Silicon does not segregate.

Q: Does this come from the inclusion of what is called dross or slag?

A: Right, dross or slag.

Aluminum oxide actually is heavier than aluminum in its pure crystalline form, but when it is present on the surface of a melt, it is usually flocculent or has air associated with it, so it floats.

Going back to the example of poor pouring practice where the man is entrapping air bubbles in the metal stream, not only are bubbles being entrapped in the metal, but he has a dross factory working full time making aluminum oxide which also becomes trapped in the metal stream and finds its way into the casting.

In the discussion of surface defects, we will confine ourselves to die castings. When metal is injected into the die under high pressure and high velocity, all the spray is collected back again into a casting. It does not all come together completely. It is not all knitted.

The metal comes together in the form of droplets that have an oxide skin on the surface and when they meet and do not fuse, they form what are known as cold shuts in the surface of the casting where two streams of metal meet and do not fuse, leaving a line or a mark of some kind on the surface of the casting.

Die castings are full of these defects. They also have trapped die lubricant in the surface of the castings which causes all kinds of trouble in anodizing, plating or cleaning.

Sand castings have surface defects too. They will have shrinkage on the surface which makes a spongy layer. They will have sand sometimes trapped in the surface.

Permanent mold castings probably are the freest of surface defects of any of the types of castings.

Sometimes a blister can be seen on the surface of a die casting. The blister is caused by air trapped in an internal cold shut and was apparent on the surface of the casting before it was machined.

Here is another instance where a zinc die casting blistered when it was belt-sanded. The casting fractured because of the blister. In the fracture a little bubble was found; and what happened was, when the casting heated up from the friction of the sanding belt, the air in the bubble expanded and caused the blister.

Q: What is the remedy for cold shut?

A: There is no pat answer to that. The remedy simply lies in the skill of the die designer to design the gates so that he can minimize turbulence in the die cavity as it is being filled with aluminum. Die casters vary markedly in this ability. There are die casters who produce beautiful castings.

Q: This has nothing to do with the temperature of the die, the die being warmed up before the operation or anything like that?

A: Yes, it does. Cold dies and/or cold metal will both definitely increase the incidence of cold shuts. Die Castings ordinarily are not subject to surface shrinkage but where die castings have heavy bosses on them or heavy flanges, it is quite frequently experienced where the internal metal solidification causes shrinkage which reaches the surface.

Q: Is it possible where you have a surface defect to tell the difference between a trapped oxide and cold shut?

A: Yes, most of the time, but it requires some experience.

Q: If there is a black spot showing, you can bet it is the oxide, but what if you have a little pin hole or mark line or what have you?

A: A cold shut usually is in the form of a line. It is very rare to have a cold shut that is a point, one little point. It is in the form of a line.

Q: Does the oxide ever occur in that form, as a line?

A: Yes, it does, unfortunately, and when it does form like that it is difficult to tell whether it is an oxide skin or a cold shut. Aluminum oxide is very strong and tenacious. Perhaps you have never seen aluminum poured, but it is very interesting to look at.

If the ladle is held close to the mold and a proper job is being done in pouring, the sprue should be full of metal and there will be a stream of metal flowing from the ladle to the sprue. The surface of the stream will be stationary, standing still. Liquid aluminum will be pouring down through a tube of aluminum oxide which is perfectly stationary. When this condition exists, metal is reaching the mold cavity in the same condition in which it left the ladle. It is a completely sealed system, no air, no dross, no oxide.

Q: No hydrogen?

A: The hydrogen was put in the metal during the melting process. However, that is not strictly true because if a very poor job of pouring is being done, the ladle is way up somewhere and the foundryman is pouring with a thin stream that does not fill the sprue, thus making a lot of bubbles and dross there, and the aluminum will pick up gas from the moisture in the air.

Q: Is there another hole in that mold where the air is escaping?

A: This is green sand and green sand is permeable. The air goes out all through the sand. It is better to have another hole in the form of a riser on the casting or a vent, or some means for permitting easy dispersion of air—but it can be done with a completely closed mold, with no exit apparent. The air all goes out through the sand. Venting is extremely important in permanent mold and die casting because the molds are not permeable, and the air must be removed. In permanent molding, the air has to flow out ahead of the metal or the mold will not fill. In die casting, the more air that can be vented the less air will be trapped inside the casting.

ANODIZING OF ALUMINUM ALLOYS

Some observations on anodizing are appropriate at this point.

Basically, any aluminum alloy can be anodized. Anodizing provides an outer coating of aluminum oxide which is hard, wear resistant, and corrosion resistant. But, if color is important and a white color is required, the alloy must be free of copper and silicon. The presence of either or both of these elements causes the coating to be dark. The 12 per cent silicon alloy, for instance will anodize practically black. That leaves only two other important alloying ingredients for the aluminum and they are magnesium and zinc. Therefore, all the alloys that anodize white are either a pure aluminum or aluminum and magnesium or aluminum and zinc. This is why the high zinc alloys, such as Tenzaloy, that were discussed earlier are good for anodizing.

There is a great interest in the aluminum die casting business today for a better anodizable die casting alloy. Presently there is the old reliable 218 with 8 per cent magnesium, but this is a very difficult alloy to handle. It drosses very readily. It is low in fluidity and it tends to have a great deal of cold shuts and entrapped mold lubricants in the surface of the casting. A lot of people are looking for a better alloy, but I doubt they are going to find it because as long as there are only magnesium and zinc to alloy with, they are not going to get a good castable alloy.

On one car, there are some letters which are pure aluminum die castings that are anodized and gold dyed. On another car there is an alloy containing 4 zinc and 1 iron which is gold anodized. The British have an alloy with about 3 magnesium, 1 manganese which they have a patent on. There are a lot of different alloys being played with around the country, but are all most difficult to cast.

A great difficulty in anodizing and die castings is the appearance of white spots after the dye is applied. My understanding of the mechanism of this is that during the anodizing in sulfuric acid, the acid becomes trapped in the porosity, whether it is shrinkage or gas or trapped air. Then when the casting is placed into the dye bath, the acid bleaches the die in those areas making white spots. The most common cause of these white spots is gas. Probably 90 per cent of the difficulty in colored anodized castings is gas.

With regard to plating, I believe that the principal difficulty in plating of aluminum or zinc die castings is porosity, because the plating solutions or cleaning solutions become trapped in the porosity. Then they are plated over and the trapped liquid will cause blisters and lifting of the plated coating.

It is almost impossible to produce a sand casting without some kind of porosity at the surface.

Die castings in general, have a very sound surface.

Permanent mold castings are generally good.

Q: But the amount of porosity is always dependent upon the mass, is it not? I mean, assuming that proper technique is applied in pouring the melt for a small mass, you would expect greater porosity for a larger mass because of differentials in solidification and things like that?

A: That is correct. The reason is that the smaller castings solidify faster and the porosity, if it is present, is very much smaller.

Q: I remember some larger castings, about 2 or 3 pounds, that invariably thousands and thousands of them were very poor. They can never get them sound, I mean, without any visible porosity.

A: It's possible to do. It depends on the skill of the foundryman, and, foundrymen vary widely in their ability to make sound castings. The reason for this is that foundrymen are good mechanics, but they are not always good metallurgists, and they do not understand the basic fundamentals of the shrinkage or gas, they do not know what to do to correct it, and most of them do not know what is wrong with the casting to start with. Half the time they are correcting the wrong thing, and that is one of the functions of the American Foundrymen's Society: to continually try to disseminate information to the foundrymen to bring them all

up, over the years, to higher and higher levels of technical competence so better castings can be made.

Q: In larger masses, do you have the problem of coring?

A: It depends on what you mean by coring.

Q: Something similar to coring in, say, steel where ingots are poured.

A: That is solidification shrinkage. Heavy castings are very difficult to make sound because the bigger the casting the more difficult it is to achieve directional solidification. Large castings in aluminum require rather drastic measures—heavy chills, insulated risers to assure that the riser stays liquid longer than the casting, so the shrinkage can be fed. The difficulty with heavy castings is that they usually stay liquid longer than the riser and, therefore, you will have shrinkage.

Q: Can you say a word about the so-called hard skin on zinc die castings, particularly? I'm not so sure about their presence on aluminum.

A: This is a characteristic of die castings in general. If we have two faces of a mold and liquid metal is shot in either aluminum or zinc, it freezes very rapidly against the mold wall making a hard, dense, tight skin. Then the interior freezes more slowly and all of the shrinkage—solidification shrinkage—takes place in the interior and you get a spongy core. It is hard just because it is chilled very quickly.

Q: How thick is that surface, or does it depend?

A: It can be from nothing to a full section. It depends on the temperature of the metal, the thickness of the casting, the temperature of the die, the speed of injection. Every variable in the business affects the thickness of that skin.

Q: If you were shooting for a certain thickness, you could?

A: I guess you could, if all of these variables could be pinned down tight enough.

Q: How about the pre-heating of the mold?

A: The molds are pre-heated. You cannot make die castings or permanent-mold castings in a cold mold. These molds are run in the neighborhood of 5 to 700F.

Q: You referred to the interior metal as spongy. What causes that? Is it shrinkage that gives you that spongy nature, the discontinuities in the metals? Is that what you referred to as spongy?

A: Yes, it is primarily shrinkage and on top of that there are air bubbles.

If it can be afforded, it is a very fascinating thing to break up castings. It is educational because in a fracture you can with a few trials very quickly identify what is wrong with the casting.

If there are voids, they can be seen. If the voids are shiny and smooth on the inside, they are air bubbles. If they are rough and dull on the inside, they are caused by shrinkage. If they are full of grey or dark material, dross has been the cause. Dross is ordinarily darker than the parent body of metal and can thus be identified.

Q: Cannot pressure on the ram overcome that sponginess?

A: No, it cannot for a very good reason: This quickly chilled skin supports the load of the ram and the liquid metal lying around inside freezes with no pressure on it. It has been found that higher pressures make the size of the bubbles smaller; does not decrease the number. They get smaller, but they are still there. High-pressure injection and higher ram pressures do not decrease shrinkage. Neither does vacuum-die casting decrease shrinkage. Shrinkage is there regardless.

There is a trend in modern aluminum die casting to have higher and higher pressures. This makes better die castings because the defects are smaller, are not so apparent.

HEAT TREATING

Q: Can you say a few words about normalizing the casting after it is finished by the machine?

A: Heat treating is a pretty big subject. Maybe the "T" numbers should be reviewed. There are such castings as T-5, T-6, T-7, T-51, T-62. "T" means heat treated. The number that follows it indicates the kind of heat treatment. T-4 means solution heat treated. It does not mean that the casting was heated in a solution. It means that the casting was brought up to an elevated temperature and held there for a substantial length of time so that the constituents of the alloy would dissolve in the parent metal. They are put in solution. Copper, for instance, is soluble in aluminum just as sugar is soluble in coffee. The higher the temperature the greater the solubility. When a casting is solution heat treated, it is taken up to 960F and held there for twelve hours. This dissolves all the copper in the casting and it goes in to solid solution. Then the casting is quenched, which retains these constituents in solid solution.

T-6 is solution heat treated and aged. After the casting is solution heat treated and quenched, it is taken back up to a lower temperature, usually 310 degrees, for three hours, which causes the constituents in solution to precipitate out. The precipitate is very small—submicroscopic—in size, and this is what strengthens the casting.

T-7 is solution heat treated plus over-aging. T-6 is not stress relieved. T-6 has a high level of stresses contained within the casting. This is because when the casting is quenched from a high temperature, the different cooling rates in the casting cause strains to be set up. When it is aged at the relatively low temperature of 310° these stresses are not relieved and, for jobs requiring very critical size or shape controls, such as in instrument housings, frequently distortion is encountered on machining because the stresses contained in the casting are relieved when some of the metal is removed, and the casting will warp.

When dimensional stability is a primary requirement, T-7 is used. This carries the aging process too far. The casting starts to soften which relieves the stresses and makes a stress-free casting.

T-5 is aged only. That means that it is cast and usually taken up to 450° for about five hours which does two things: The stress is relieved and it precipitates any constituents that happen to have been left in solid solution at the time the casting solidified; so that the casting is dimensionally stable and stress free.

Now, you will often times encounter numbers after the "T": like 62 or 571 or T-71. The additional digits merely mean modifications of the basic practice.

Q: What temperature do you reach in T-7?

A: T-7 is usually at 400° or 440° for the aging and usually for something like 9 hours.

Q: You are losing some of the effects of your heat treating.

A: Yes, sir. T-71 is practically back to where it was cast. In fact, in heat treated alloys, it is impossible to have freedom from stress and full strength. You cannot have both. Full strength is only achieved by aging at 310° which retains all the stresses. If you want to get ride of the stresses, over-aging must take place. If we age at 310°, the strength and hardness

will continually increase to about 24 hours and then they will level out. Nothing more happens. If we age at 440°, the same thing happens, but at a much more accelerated pace and the properties reach a peak and then decrease. You must get over the hump, for stress relieving to take place.

Q: In the designation of alloys, as far as chemicals are concerned, you named the major composition. Isn't it possible to have a few more alloys included?

A: Several. In fact, quite a few. In addition to the common elements such as copper, magnesium, silicon and zinc, every aluminum alloy has iron in it, every single one unless you buy 99.99 per cent pure aluminum. The reason for that is that Bauxite ore from which the aluminum came originally always has large quantities of iron in it which are extremely difficult to remove entirely. The iron follows the Bauxite through the purification to alumina, follows through the electrolytic reduction and ends up in the aluminum. When one buys 99.50 per cent pure aluminum, it will always have around 25 to 35 hundredths of iron in it. Die casting aluminum alloys will usually contain pretty close to 1 per cent iron, and it is there for a good reason—two good reasons. Molten aluminum is a universal solvent. There is no known metal that it will not dissolve. It will chew up anything. Iron is quite soluble. The presence of 1 per cent iron in aluminum alloy decreases its potential for more iron. Therefore, it does not eat the die casting die.

One of the most common problems in the die casting of aluminum is called soldering, and happens when the casting welds to the die. This is because the aluminum starts to dissolve the iron and sticks to it. When 1 per cent iron is added to the aluminum, it cuts down that tendency quite markedly. Another good reason for adding iron is that when the casting solidifies in a die, it is very weak just after it has frozen. It has no strength. If the casting is large and has thin walls, it will tend to crack as it solidifies around a core. The presence of iron decreases that tendency.

Also, manganese will be found in aluminum alloys, plus chromium, nickel, and titanium. In alloys in this category one will find zinc as an impurity. Whether an element is an impurity or an alloying ingredient depends upon the desired alloy. If zinc is not supposed to be present, zinc is an impurity. Most copper-silicon alloys have magnesium as an impurity and it will be present at less than 0.1 per cent.

Q: In any particular alloy by name, then, what possible variations might you have if you just blatantly order say 356 or 380, or what have you? Would it always be the same lot to lot or would you have to have specifications when you make this order?

A: No, it definitely will not be the same. The various specification-writing agencies all have their own specifications. Federal specifications, ASTM, SAE, Aluminum Association military specifications, primary producers specifications, secondary producer specifications, they are all different. For instance, in iron you will find limits all the way from 0.15 to as high as 1.2 per cent. Manganese from as low as 0.10 to as high as 0.8 per cent.

COPPER ALLOYS

Copper should receive brief consideration. Copper is the most significant element in controling the corrosion resistance of aluminum alloys. In small amounts, it is extremely critical. Copper at 0.1 per cent max is one class of alloy, 0.3 max is another class, 0.6 max is another class, and then when you get above about 2 per cent, from there on they are all nearly the same. It does not make much difference how much more copper is present, all copper alloys have about the same corrosion resistance. These three levels here are critical. For instance, in cast cookware which is usually 43 alloy, with 5 per cent silicon, copper is specified at 0.30 max. The difference between the 0.30 max, and 0.60 max, is significant in controlling the rate at which the aluminum will darken under the action of boiling water.

Then, if you want another level of corrosion resistance you must go down to 0.10 max, or even lower—the less, the better. Zero copper is best of all. Silicon has relatively little effect on the corrosion resistance. It does not make any difference whether it is absent or present, and it does not make any difference how much of it there is; whether it is 1 per cent or 10 per cent, it is all the same. Magnesium can be considered as good. Actually, the high magnesium alloys in certain environments are more corrosion resistant than aluminum that is free of magnesium. Chromium is added to a great many wrought alloys to improve the resistance to stress corrosion.

In casting alloys, chromium is not very often found.

Q: I am having trouble plating 356 alloy with a T-6 condition. Is this due to the alloy or T-6 condition, or something else?

A: First tell us what is the trouble.

Q: We have blistering.

A: I believe your troubles are due to porosity and are not related to either the alloy or the heat treatment.

Donald L. LaVelle received a BS degree in metallurgical engineering at the University of Washington, Seattle, Washington and his MS in the same subject from the Montana School of Mines, Butte, Montana. He is with the American Smelting and Refining Company, research department, in charge of aluminum research and development. He was previously manager of pig and ingot products, Kaiser Aluminum and Chemical Sales, Inc.; assistant manager, Federated Metals Div., American Smelting and Refining Company; in the research department of ASARCO's aluminum alloy research and technical sales service; and with the materials laboratory, Aluminum and Magnesium Foundries, Wright Aeronautical Corp. Mr. LaVelle is a member of AFS, ASM, AIME; past chairman, Light Metals Division, American Foundrymen's Society; chairman, aluminum ingot committee, ASTM. He has published many papers and spoken widely on foundry problems and technology.

PLATING TANK DRAINS THAT MEET PHILADELPHIA REQUIREMENTS

by WILLIAM E. GRAUL

In the City of Philadelphia, plating tanks are plumbing fixtures. Drain and overflow piping and connections come under the jurisdiction of the Plumbing Unit, Department of Licenses and Inspections. Disposal of wastes is subject to the authority of the Industrial Waste Division of the Sewer and Water Department.

The Philadelphia Plumbing Code, issued in 1930 and still an effective and well defined Code for the most part, states that "No special equipment of any description for a hospital or institution of a similar character, manufacturing establishment, chemical laboratory, or other laboratory, or any other place where special equipment is required which necessitates connections with the vent pipes or the general drainage system of a building shall be installed until plans of the proposed installation shall be submitted to the Bureau of Health."

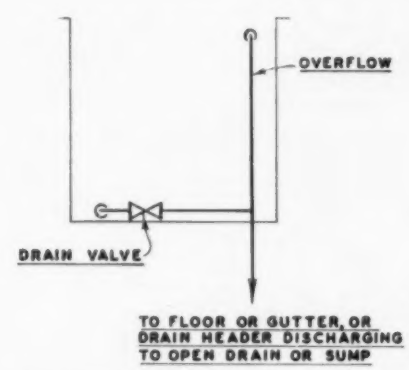
The Plumbing Unit, Department of Licenses and Inspections, has ruled that the above requirement includes plating and other open surface treatment tanks, and that tank drains and overflows may not discharge to a drain trench or gutter, or to the floor and thence to drain, or even to an open 'safe-drain", but must rather be permanently connected to the drainage system.

This leads to the rather unusual decision that tank drains and overflows must be trapped. Where a tank has both a drain and an overflow they can both be served by one trap in much the same manner as a bath tub; if there is no overflow the valved drain must still be connected to the drainage system and trapped like any other plumbing fixture. Like other "small" plumbing fixtures the distance to a vented line must not exceed 12 feet. The reason for the trap is for the prevention of sewage odors when the valve is open, and in the case of an overflow to prevent said odors from coming out in the room during normal operation. The use of traps also entails venting of the drain lines in the usual manner of plumbing through the roof in order that one trap may not siphon out the seal from other traps.

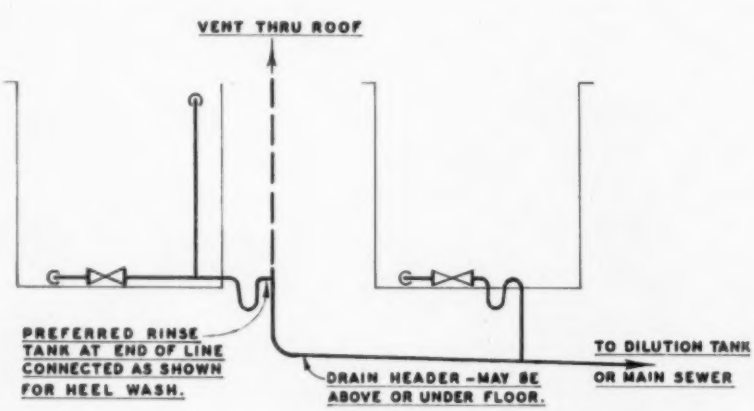
Equipment drains such as plating and other process tanks in most parts of the country can be connected by plant maintenance men because they usually discharge to an open drain. In Philadelphia this is not permissible since a Registered Master Plumber must make all sewer connections, and tank drains and overflows are considered sewer connections.

At the present time there are a few traps available in corrosion-resistant materials, such as PVC S-traps. It is to be hoped that the manufacturers will soon expand their lines to include P-traps in PVC, stainless steel, and other materials. In the meantime the Plumber will make his own traps, using a combination of standard fittings, with cleanout protected by the seal of the trap.

William E. Graul is a consulting engineer specializing in plating and other metal finishing operations. He received a BME degree with Industrial Option from the University of Detroit in 1938. During his career, he has been with Sears, Roebuck in Detroit, the Philadelphia Navy Yard, Du Pont de Nemours at Wilmington, American Viscose, and a partner in the Jack Steele Company of Philadelphia. He has operated his own consulting business since 1955. Mr. Graul is a registered professional engineer and a member of the AES, Philadelphia Branch.



ORDINARY METHOD



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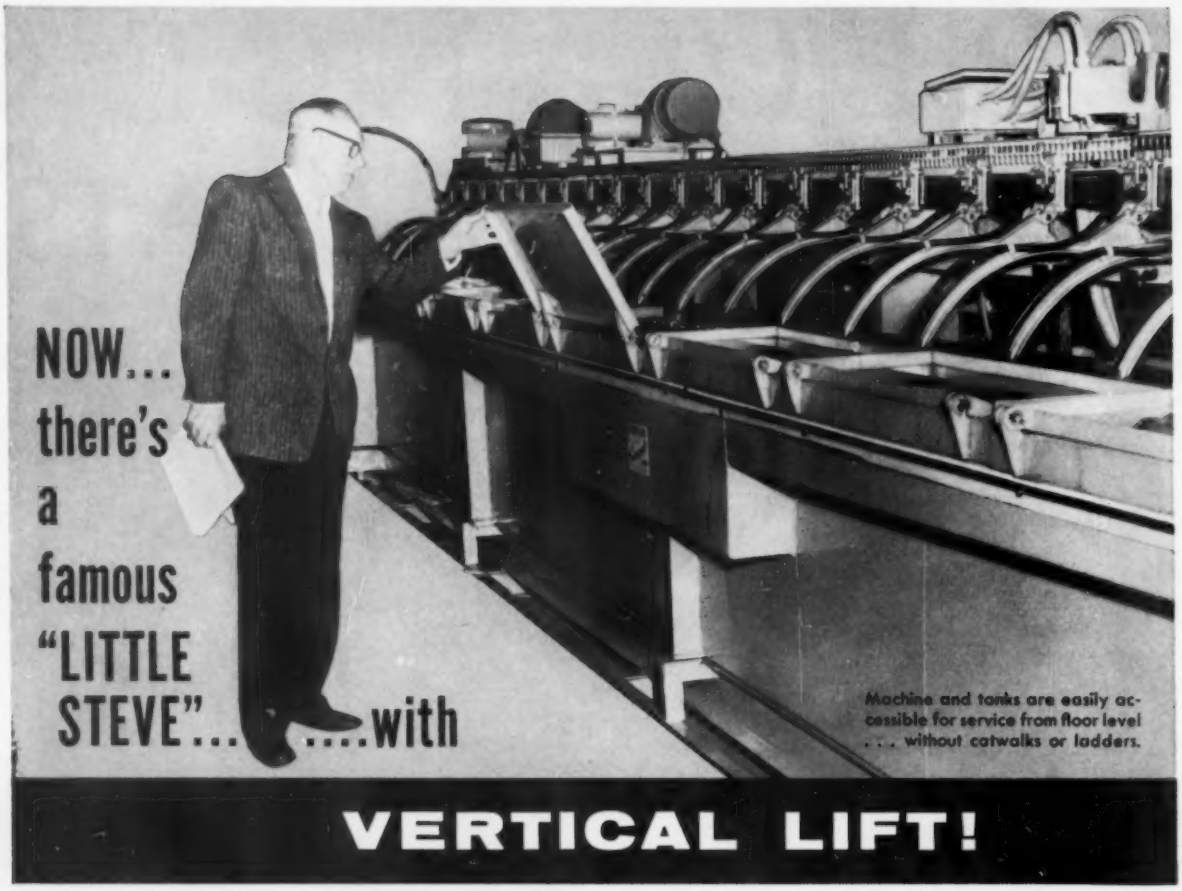

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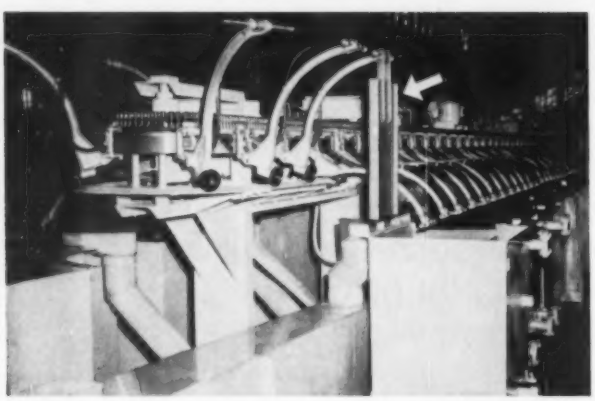

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A UDYLITE TRIPLE PLAY . . .

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Not customary but entirely "in order" is this shipment rushed by Udylite special messenger Ernie Jennings direct to planeside in Detroit, where Pan-Am stewardess Ellen Manners starts it on its way to South Africa. Just 39 hours later delivery is made in Johannesburg, 9036 miles away.

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NEW TOOL TO AID BRANCHES INCREASE MEMBERSHIP

Supplementing the Society's popular booklet, "AES Membership: Its Meaning to YOU," successfully being used by National Headquarters in answering membership inquiries internationally, a two-colored, six-page gatefold membership promotion leaflet specifically pinpointed to Branch memberships, together with a perforated Application Blank, has been created by the National Office, commended by the Membership Committee and the Executive Board.

Copies of the new leaflet, with confidence of its effectiveness as a membership promotion medium helpful to AES chartered Branches, have been issued to all Branches for immediate employment as a visual aid in AES's Societywide mission to expand its respective Branch memberships.

It is the plan of the Membership Committee, led this year by Indianapolis Branch President M. Lester Reynolds, that, after effectively exhausting its present supply, each Branch will seek replenishment for even broader coverage of its area reservoir of qualified men and women who should be AES members and who have not yet been inspired to apply for membership.

LOS ANGELES LEADS AES MEMBERSHIP AT HALFWAY MARK

At the fiscal six-month mark, namely from July 1, 1959 to January 1, 1960, the Los Angeles, Rochester and Phoenix Branches led the field in their respective divisions in the AES Annual Branch Membership Expansion Competition. Those Branches ahead as of June 30, 1960 will be declared winners in their respective divisions. Each will then be presented with a $50.00 Award at the Supreme Society Annual Meeting to be held at Los Angeles, July 28, 1960 plus, of course, attendant recognition in PLATING MAGAZINE:

Aggregate AES membership that naturally fluctuates from day to day, stood at nearly 7700 members at December 31, 1959, including Active Members, Members-at-Large and Sustaining Memberships.

At the six-month point, leaders in the AES's respective divisions were:

BRANCH	Members July 1, 1959	New Members	Net Change Membership (See Note)	Per Cent Change
FIRST DIVISION (126 Members and Over)				
1. Los Angeles	278	10	+23.5	+ 8.5
2. Newark	354	29	+18.5	+ 5.2
3. Bridgeport	143	11	+ 4.5	+ 3.1
4. Hartford	172	6	+ 2	+ 1.2
SECOND DIVISION (70-125 Members)				
1. Rochester	84	3	+ 3	+ 3.6
2. Columbus	79	3	+ 1.5	+ 1.9
3. Montreal	112	6	+ 2	+ 1.8
4. St. Louis	109	7	+ 1	+ 0.9
THIRD DIVISION (10-69 Members)				
1. Phoenix	27	9	+ 9	+33.3
2. Denver	31	10	+ 7	+22.6
3. Allentown-Reading	37	8	+ 8	+21.6
4. Blue Ridge	35	8	+ 4	+11.4

NOTE: Includes all membership changes, including elections, reinstatements, resignations, suspensions, etc. for the six-month period.

Mrs. A. R. Hoffman
Cleveland 1955

Mrs. A. G. Pierdon
Washington 1956

Mrs. G. R. Davidson
Montreal 1957

AMONG AES ROLES PLAYED BY THE SOCIETY'S LADIES

It is no bombshell of news that AES ladies are the bellwethers of many social functions that supplement the educational prime mission of AES National Conventions—and that the planning and toil devoted to such large and demanding ladies' affairs are vital influences in the total success of any such four-day assembly.

AES has been fortunate in the quality of the talent composing the Ladies Committees of its Annual Conventions through the years—and is especially proud of the grade of the leadership of such important Committees. Above, for example, are the Ladies Committee Chairmen of its six most recent Conventions—and similar charm and competence existed too in their predecessors.

Mrs. R. D. Miller
Cincinnati 1958

Mrs. Alice Pillsbury
Detroit 1959

Mrs. G. J. Beckwith
Los Angeles 1960

TO ALL BRANCH SECRETARIES

1. **Your Branch President and you as Branch Secretary have now received from National Headquarters, your Branch's Return Sheet through which your Branch can nominate any qualified member in good standing whom it pleases for the 1960 CHARLES HENRY PROCTOR MEMORIAL LEADERSHIP AWARD, the AES's highest non-technical, non-scientific honor. That Return Sheet, properly signed by your Branch President and by yourself, should be in the hands of the National Executive Secretary by or before April 1, 1960 for consideration by the Award's Selection Committee for this year's Award. Your Return Sheet, to be acceptable to the Selection Committee, must be accompanied by SEVEN copies of a statement of accomplishments of your nominee buttressing his nomination.**
2. **Your Branch has received from National Headquarters, a quantity of a two-color, accordion-fold combination AES membership promotion piece and Application Blank. Initiated by the National Membership Committee and prepared by Headquarters, these leaflets are intended to assist your Branch to increase its membership. The new item does not replace "AES Membership: Its Meaning to YOU" so successfully being used by National Headquarters in answering membership inquiries, particularly for Membership-at-Large. It supplements it.**

AES NEWS

AES THANKS . . .

ASAE CITATION FOR AES ACTIVITIES

"In recognition of the meritorious entry submitted in the 1959 Awards Activities sponsored by the American Society of Association Executives, we hereby cite for special appreciation, AMERICAN ELECTROPLATERS SOCIETY, INC.

"This achievement, made possible by the creative effort of its dedicated members and staff, represents a unique and outstanding contribution to association management, which is highly deserving and well earned. In recognition of this superior effort in the public service and to your industry in the year 1959, we set our hand and seal."

AMERICAN SOCIETY OF ASSOCIATION EXECUTIVES
William Dalton, President
Paul A. Sloane, Chairman
Glenn B. Sanberg, Executive Vice President

●

A GOVERNMENT VIEW OF "TECHNICAL PROCEEDINGS"

"Regarding your 400-page GOLDEN JUBILEE EDITION of "TECHNICAL PROCEEDINGS" received this week, I want to hasten to state—What a whale of a job . . . How useful this will be, throughout the world, to the countless persons concerned with electroplating and metal finishing.

"We have records in this part of the U.S. Department of Commerce of some 5,000 national associations, societies, etc. Your volume is one of the finest reports of its type which we have had the pleasure of seeing, prepared by an association."

U.S. DEPARTMENT OF COMMERCE
Jay Judkins, Chief
Trade Association Division

NATIONAL PRESIDENT ADDRESSES KANSAS CITY; OTHER SIGNIFICANT MEETINGS AHEAD

The Kansas City Branch's "National Officers Night" held in that community Thursday, December 10, brought to that well-programmed and attended meeting, National President Ralph D. Wysong himself who addressed that swelling Branch on AES national affairs. Recently returned from an AES West Coast trip, AES's national head made the trip to that fine Branch by special invitation. Branch President G. Scott Sterrett who, with a Kansas City Branch delegation had just arrived from the "Aerospace Finishing Symposium" in Texas, presided. The meeting was arranged by Branch Librarian William E. Des Jardins.

This is but one of a number of Branch meetings of significance reported to National Headquarters. Others include the noteworthy Dixie Region, Grand Rapids and Chicago Branch Annual Meetings held in January that will be reported in March PLATING.

The New York "Mother" Branch will hold its Annual Meeting at the Statler Hotel, New York, February 6. The Philadelphia Branch will conduct its Fiftieth Anniversary commemorative, February 19-20, concurrently with the Seventh Interim Meeting of the Supreme Society.

The new Phoenix Branch, led by its Founder-President William Griff and its alert Branch Librarian Paul Wilbe, is planning a symposium to be held in Phoenix, March 26.

April will feature, among other interesting educational meetings, the Sixth Tri-State Regional Meeting to be held in Cincinnati, April 23, and the Twenty-First New England Regional Annual Meeting to be held in Hartford, with Bridgeport as host, on that same popular Saturday. A week later, the Empire State Region will conduct its Sixth Empire State Regional in Elmira, N. Y. with the Southern Tier Branch as host. The traditional Baltimore-Washington Branch meeting at which the National President will receive the "pot" of the Order of Past Presidents will be held on April 9 in Baltimore. The always popular annual Meeting of the Milwaukee Branch will occur on April 30.

If your Branch has not yet reported the date of its Annual Meeting to National Headquarters to be included in the "Future Meetings" section of PLATING, you are urged to do so.

INVITATION TO BRANCHES TO HOST 1966 AES CONVENTION

Under its current policy whereby it chooses AES National Convention sites six years in advance, the Supreme Society, AES's summit governing council, will select, at its Annual Meeting, Los Angeles, July 28, 1960, the site and Host Branch of the 53rd Annual Convention of the Society to be held in 1966.

Any AES Branch wishing to be considered by the Supreme Society as possible Host of that 1966 Annual Convention is invited to have its *documented* invitation in the hands of the National Executive Secretary by or before July 1, 1960 for the preliminary consideration of the Executive Board at its meeting on July 24.

Interim Meeting sites, moreover, are now chosen by the Supreme Society two or more years in advance. Any AES Branch desiring Supreme Society consideration as possible Host Branch of the 1962 Interim Meeting is urged to have its *documented* invitation in the hands of the National Executive Secretary by or before July 1, 1960.

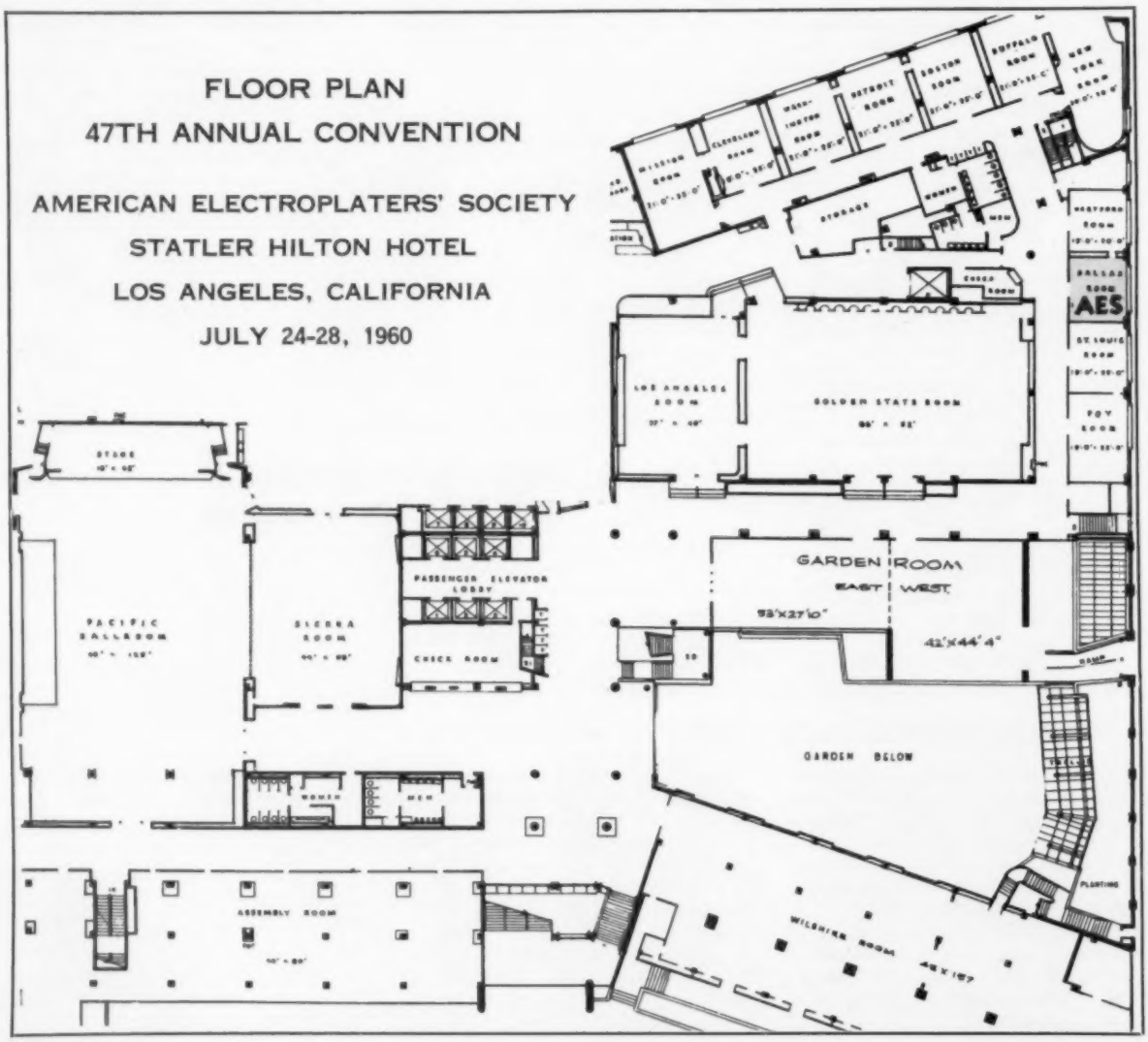
NATIONAL PRESIDENT HEADS PROCTOR AWARD COMMITTEE

The Charles Henry Proctor Memorial Leadership Selection Committee for 1959–1960 is headed by National President Ralph D. Wysong and is composed, besides Mr. and Mrs. William O. Preston (the donors), of National Executive Secretary John P. Nichols, Research Committee Chairman James D. Thomas, Order of Past Presidents Chairman Samuel Heiman, Buffalo Branch President Rolland E. Campbell and British Columbia Past President James Lee.

Each of these is ineligible, of course, to participate in any way in the discussion or action of any AES Board, Branch, Committee or Order of which he may be head or member, nominating any AES member in good standing for the Proctor Award. Branch and committee nominess will be judged competitively entirely upon the merit and significance to AES, of the 1958–1959 deed or deeds upon which their respective AES Board and/or Committee nominations are predicated.

Ultramodern Statler Hilton Hotel, Los Angeles, AES 1960 Convention Headquarters.

AES Board and Committee meetings will be held in rooms similar to above.



RARE OPPORTUNITY BECKONS AES MEMBERS TO CALIFORNIA CONVENTION

At the six-month mark prior to occurrence, forecasts appear unanimous that AES's 47th Annual Convention—to be held at the Statler Hotel, Los Angeles, July 24–28, 1960—shapes up as one of the finest AES family assemblies in the Society's half-century history to date—a worthy follower of the superb GOLDEN JUBILEE CONVENTION of 1959 in the batting order of AES Annual Meetings.

Well-timed to draw AES families to America's renowned vacationland at best season for combined Convention attendance and family holiday, this first AES Convention westward beyond St. Louis is also being programmed so as to provide educational inducements so important to the enrichment of knowledge in electroplating, metal finishing and allied arts that it will attract deserved large AES assembly despite distance of travel. And that's not all. Supplementing its educational appeal are sightseeing, entertainment and relaxational values noteworthy in the impressive lineup of past AES Conventions.

OUTSTANDING EDUCATIONAL PROGRAM BLUEPRINTED

Against the background of the touted climate of this continent's Pacific Coast "Shangri-La," and the luxury of the Statler Hotel of the "Wonder City," the 47th Annual Convention will spread an educational sessions program featuring some 37 technical papers grouped into 9 sessions. These will include the second annual "William Blum Lecture"—this one being delivered by Dr. A. K. Graham, second winner of the AES Scientific Achievement Award. Versatile and comprehensive as to coverage of plating, metal finishing and allied arts subjects of wide interest to AES's broad membership, the educational program will also include a session on organic coating plus a full-day's "Hydrogen Embrittlement in Metal Finishing Symposium," together with an evening's round table forum on the very same subject.

There will also be an attractive convention Opening Session—entertainment galore during "off-duty" hours—an outstanding floor show and dance—a sumptuous Farewell Banquet—other impressive evening relaxational events. And an underscored "PLUS" will, of course, be the Outing itself, meaning a never-to-be-forgotten visit to Disneyland.

CHILDREN'S PROGRAM PACKAGE NOTEWORTHY

Being a Convention where California scale and flair will be suitably lavished upon all elements of the AES family, the Society's ladies will be treated to a program by Ladies Chairman Dolly Beckwith and her able Committee that will not only run the gamut of usual Convention events but which will also add such Los Angeles specialties as a guided bus tour of the "Homes of the Stars"—a visit to famed Farmers Market—a pool-side luncheon at the Beverly-Hilton, sweetened by a California fashion show and a diving exhibition.

The Los Angeles area is packed with attractions that are the dream to see of much of American youth. Families bringing their children to the AES's 1960 Los Angeles Convention will consequently give them opportunity to build youthful memories there that will be treasured for a lifetime.

Transported by bus and supervised by counsellors, for example, AES's youth will view Knotts Berry Farm—the world-famed Oceanarium—Disneyland—motion picture studios—either the ranch of "Crash" Corrigan or of Gene Autry. For this four-day children's memorable fare, including transportation, supervision and each day's box lunch, the over-all package per child will cost parents but $18, not, of course, including Banquet ticket. Optional but available, Banquet tickets for AES's youth will be purchasable separately

OPPORTUNITY THAT KNOCKS BUT ONCE

The adult registration fee of the 47th Annual Convention, without establishing a precedent, will necessarily be $25 per adult male or female. This blanket fee will include admittance to all male and female educational, relaxational and entertainment functions of the Convention, including Banquet.

The 1960 Convention will present AES members and their families with the only foreseeable opportunity to combine a West Coast vacation with AES Convention attendance. In 1961, AES's Annual Convention will be in historic Boston—in Milwaukee in 1962—in Atlantic City in 1963—in St. Louis in 1964—in New York City in 1965. Hence, this California OPPORTUNITY, foreseeably, will knock for AES members and their families but once. CAN YOU AND YOURS AFFORD TO MISS IT?

(Top) Veranda Room of the Los Angeles Statler Hilton Hotel. (Below) AES Conventioneers will dine and dance in the beautiful Terrace Room.

TENTATIVE PROGRAM

This is a TENTATIVE PROGRAM as of January 31, 1960. Additions and modifications will be made monthly until finalized.

SUNDAY, JULY 24

9:00 a. m.	Executive Board Meeting (All Day)	Dallas Room (Hq. Room)
2:00 p. m.	Honorary Membership Award Committee Meeting	Washington Room
2:00 p. m.	Scientific Achievement Award Committee Meeting	St. Louis Room
3:00–5:00 p. m.	Ladies Program. California Welcome Tea	(To be Announced)
4:00 p. m.	Credentials Committee Meeting with Executive Board	Dallas Room
8:00 p. m.	Get-Together Party	(To be Announced)

MONDAY, JULY 25

9:00 a. m.	Children's Program—Supervised Visit to Marineland and Knott's Berry Farm (subject to change)	(Bus time to be Announced)
10:00 a. m.	Grand Opening Session	Golden State Room
11:00 a. m.	Business Meeting, Supreme Society	Golden State Room
12:00 noon	Branch Secretaries' Luncheon	New York Room
12:00 noon	Ladies Program. Luncheon and Entertainment	(To be Announced)
12:15 p. m.	Speakers' Luncheon	Cleveland Room
2:00 p. m.	Educational Opening Session Second Annual "William Blum Lecture" (Dr. A. Kenneth Graham, Second Winner, "AES Scientific Achievement Award".)	(To be Announced)
2:00 p. m.	Plant Inspection Trip	(To be Announced)
2:30 p. m.	Editorial Board Meeting	Boston Room
2:30 p. m.	Educational Session A "Statistical Analyses Applied to Plating Processes" "Metal Finishes and Problems in the Missile Field" "Safety in the Plating Room"	(To be Announced)
2:30 p. m.	Educational Session B Organic Coating (Papers to be Announced)	(To be Announced)
4:00 p. m.	Order of Past Presidents' Business Meeting	Detroit Room
6:30 p. m.	Order of Past Presidents' Dinner	Washington Room
8:00 p. m.	Open House (Sponsored by Metal Finishing Suppliers' Association)	(To be Announced)

TUESDAY, JULY 26

8:00 a. m.	Charles Henry Proctor Memorial Leadership Award Selection Committee Breakfast	(To be Announced)
8:00 a. m.	Speakers' Breakfast	Cleveland Room
9:00 a. m.	Membership Committee Meeting	(To be Announced)
9:00 a. m.	Public Relations Committee Meeting	Detroit Room
9:00 a. m.	Educational Session C "Recent Developments in Gold Electroplating" "Thick Gold Deposits" "Acid Gold Plating" "Precious Metal Plating in Printed Circuits"	(To be Announced)
9:00 a. m.	Educational Session D "Outdoor and Accelerated Corrosion Test Comparisons" "Corrosion Resistance Progress Reports" "New Procedures for Plating Zinc Diecastings" "Effects of Variation in Copper Plating on Corrosion Performance"	(To be Announced)
1:00 p. m.	Annual Outing	Disneyland

WEDNESDAY, JULY 27

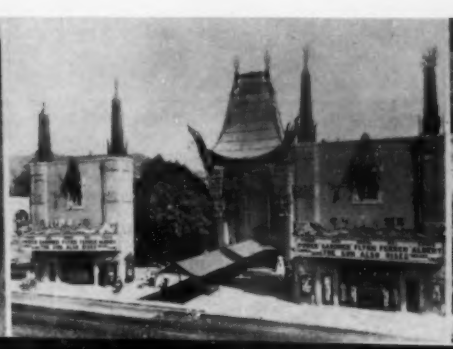
8:00 a. m.	Research Committee Breakfast	Cleveland Room
8:00 a. m.	Speakers' Breakfast	Buffalo Room
9:00 a. m.	Educational Session E—"Hydrogen Embrittlement in Metal Finishing" Symposium (Papers to be announced)	(To be Announced)
9:00 a. m.	Research Committee Meeting	Detroit Room
9:00 a. m.	Publications Committee Meeting	Boston Room
9:00 a. m.	Educational Committee Meeting	Washington Room
9:00 a. m.	Children's Program—Supervised bus view of "Homes of the Stars" and guided tour, motion picture studio (subject to change)	(Bus time to be Announced)
12:00 noon	Joint Educational Committee and Branch Librarians' Luncheon	New York Room
12:00 noon	Speakers' Luncheon	Buffalo Room
12:30 p. m.	Ladies' Program "Luncheon Around the Aqua Pool" and California Fashion Show	Beverly Hilton Hotel
2:00 p. m.	Research Committee Meeting	Detroit Room
2:00 p. m.	Educational Session F—"Hydrogen Embrittlement in Metal Finishing" Symposium (Papers to be announced)	(To be Announced)
7:30 p. m.	Round Table Discussion on "Hydrogen Embrittlement in Metal Finishing"	(To be Announced)
9:30 p. m.	Floor Show and Dance	Pacific & Sierra Rooms

THURSDAY, JULY 28

8:00 a. m.	Speakers' Breakfast	St. Louis Room
9:00 a. m.	Ladies' Program. TV Show and Breakfast in Hollywood	(Bus time to be Announced)
9:00 a. m.	Business Meeting, Supreme Society	Sierra Room
9:00 a. m.	Educational Session G "A Study of Variation in Certain Characteristics of Bright Nickel Deposits with Variation in Bath Temperature" "Magnetic Properties of Electrodeposited Cobalt Alloys" "Sulfamate Plating Solutions of Cobalt, Iron and Cadmium" "Electroless Nickel"	(To be Announced)
9:00 a. m.	Educational Session H "Cleaning Techniques in Electronics Industry" "Study of Anodic Coatings on Aluminum" "Solution Transfer in Plating Barrels" "New Method of Chrome Plating Directly on Aluminum"	(To be Announced)
9:00 a. m.	Children's Program—Supervised visit of Corriganville or Gene Autry Ranch (Subject to change)	(Bus time to be Announced)
9:30 a. m.	Plant Inspection Trip	(To be Announced)
11:00 a. m.	Ladies' Program. Bus View of "Homes of the Stars"	(Bus time to be Announced)
12:30 p. m.	Ladies' Luncheon (Dutch Treat) and Shopping, Farmer's Market	Farmer's Market
1:00 p. m.	Plant Inspection Trip	(To be Announced)
2:00 p. m.	Business Meeting, Supreme Society	Sierra Room
2:00 p. m.	Educational Session I "AES Research and Its Seven Active Projects" "Corrosion Problems with Decorative Chrome" "Dual Chrome Systems" "Chrome Plating Rifle Barrels"	(To be Announced)
7:00 p. m.	Annual Banquet and Dance	Pacific & Sierra Rooms

FRIDAY, JULY 29

8:00 a. m.	President's Breakfast to National Officers & Families	AES Executive Suite
9:00 a. m.	Executive Board Meeting	Dallas Room



CITY OF PHILADELPHIA

Tribute

Philadelphia Branch American Electroplaters' Society

The past half-century has been a period of tremendous progress and accomplishment in the field of electroplating and metal finishing.

Philadelphia has long been a leading center for this industry, having made considerable contributions through the industry to the national economy.

Much of the area's progress in the field can be attributed to the efforts of the Philadelphia Branch, American Electroplaters' Society, the second oldest chartered unit of the national organization.

The Quaker City Branch is celebrating its Fiftieth Anniversary this year, and it is appropriate that Philadelphia has been chosen the site of the Seventh Interim Meeting of the Supreme Society this February 19–20 to serve as the climactic event of its half-century observance.

The City of Philadelphia joins with the national Society in honoring the Philadelphia Branch on its Golden Anniversary and lauding its efforts as one of the most energetic groups in the nation.

Richardson Dilworth
Mayor

Fredric R. Mann
City Representative

HOST: AES PHILADELPHIA BRANCH

INTERIM MEETING REPORTER

BEN FRANKLIN HOTEL PHILADELPHIA, PA. FEBRUARY 20, 1960

PHILADELPHIA BRANCH OBSERVES FIFTIETH ANNIVERSARY AT MAJOR WINTER MEETING

The Philadelphia Branch, observing its own Fiftieth Anniversary, will stage a well-planned two-day Golden Anniversary Program at the Ben Franklin Hotel of that city, February 19–20, 1960 concurrently with the Seventh Interim Meeting of the Supreme Society, AES's governing council, to be held at the same site, February 20.

Actually, the Philadelphia events will be prefaced by a full-day's meeting of the AES Research Committee to be held at the Ben Franklin Hotel, Thursday, February 18. The Executive Board will conduct its regular winter meeting at that same hotel all-day on Friday February 19—and will conduct its traditional joint session with the Board of Trustees of the Metal Finishing Suppliers' Association on the evening of that same day, February 19. The Supreme Society will convene in Interim Meeting at 10 a.m. Saturday, February 20. The AES Membership Committee will have a breakfast meeting before the Supreme Society convenes.

The Philadelphia Branch's observance of its half-century anniversary will include two educational sessions—a plant tour—a cocktail party after the Supreme Society meeting on Saturday, February 20—plus a gala Banquet, floor show and dance as conclusion of its impressive two-day event.

AES has a rich Pennsylvania background with three other chartered Branches also domiciled in that Commonwealth besides Philadelphia, namely Pittsburgh, Lancaster and Allentown-Reading. AES National Headquarters, in fact, was located in Jenkintown in 1946–1952, and AES operated as an authorized New Jersey Corporation in the Commonwealth until April 1952 when Headquarters was moved to its present home in the American Building, Newark, New Jersey.

Philadelphia's official view of AES generally and of its Philadelphia Branch specifically is exemplified by the message sent by its Mayor Richardson Dilworth to the Society during AES's GOLDEN JUBILEE in 1959:

"The past half-century," he said in part, "has been a period of tremendous progress and accomplishment in the field of electroplating and metal finishing, and I am happy to say that Philadelphia has had a hand in the contribution that your industry has made to the national economy. Our city has long been a leading center of your industry. It is also the home of one of the largest and most energetic Branches of your Society."

PROGRAM

FIFTIETH ANNIVERSARY, PHILADELPHIA BRANCH AND SEVENTH INTERIM MEETING, SUPREME SOCIETY

BEN FRANKLIN HOTEL, PHILADELPHIA, FEBRUARY 18-21, 1960

THURSDAY, FEBRUARY 18

9:30 a.m.—AES Research Committee Meeting (All Day) ..... Lafayette Room

FRIDAY, FEBRUARY 19

9:00 a.m.—AES Executive Board Meeting (All Day) ..... Executive Suite
10:00 a.m.—Registration, Branch Fiftieth Anniversary ..... Mezzanine Foyer
2:00 p.m.—Plant Tour (Sellersville Plant, American Machine & Metals Co.) ..... Bus Leaves 2 p.m.
6:00 p.m.—Dinner (Dutch Treat) ..... (To be announced)
7:30 p.m.—GRAND OPENING Session, Branch Fiftieth Anniversary ..... Betsy Ross Suite
8:00 p.m.—Educational Session "A" ..... Betsy Ross Suite
"Remedies for Corrosion of Nickel Chromium Coatings" by Dr. W. A. Wesley, International Nickel Co.
"Zinc and Cadmium Plating" by John Winters, Incar, Inc.
8:00 p.m.—Joint Meeting, Executive Board, American Electroplaters' Society and Board of Trustees, Metal Finishing Suppliers' Association ..... Executive Suite

SATURDAY, FEBRUARY 20

7:30 a.m.—Breakfast Meeting, AES Membership Committee ..... Robert Morris Room
8:00 a.m.—Registration, Branch Fiftieth Anniversary ..... Mezzanine Foyer
8:00 a.m.—Registration, Delegates-Alternates, AES Supreme Society ..... Mezzanine Foyer
10:00 a.m.—Seventh Interim Meeting, Supreme Society ..... Franklin Suite
10:00 a.m.—Educational Session "B" ..... Betsy Ross Suite
"Hard Anodizing" by Dr. Harold J. Wiesner, Bendix Aviation Co.
"Anodizing and Chemical Finishes" by Russell VandenBerg, Aluminum Company of America
"Plating on Aluminum" by William K. Murray, Enthone, Inc.
1:00 p.m.—Seventh Interim Meeting Luncheon (Dutch Treat) ..... Washington Room
2:00 p.m.—Seventh Interim Meeting, Supreme Society ..... Franklin Suite
6:00 p.m.—Fiftieth Anniversary Cocktail Hour ..... Franklin Suite
7:00 p.m.—Fiftieth Anniversary Banquet and Floor Show ..... Crystal Ballroom

SUNDAY, FEBRUARY 21

9:00 a.m.—AES Executive Board Meeting ..... Executive Suite

AGENDA

SEVENTH INTERIM MEETING AES SUPREME SOCIETY

BEN FRANKLIN HOTEL, PHILADELPHIA, PA. FEBRUARY 20, 1960

1. Welcome by Philadelphia Branch
2. Welcome by National President and Congratulations to Philadelphia Branch on its Fiftieth Anniversary
3. Opening of the Session as an Interim Meeting
   Purpose of the meeting as a sounding board on matters for subsequent consideration and action by the Supreme Society at its Annual Meeting in Los Angeles, July 28, 1960
4. Progress and Status Reports:
   Financial by President
   Educational by First Vice President
   Membership by Second Vice President
   Branch Regionalization, Regional Annual Meetings and Branch Convention Exhibits as Tools of AES Educational Mission by Third Vice President
   Honorary, Merit and Achievement Awards as Inducements for Greater AES Service by Immediate Past President
   Headquarters and AES Publishing and Public Relations by National Executive Secretary
   AES Research Program by Chairman, Research Committee
5. Preliminary Reports:
   a) Executive Board Appraisal as to AES Investments
   b) Executive Board Recommendations for AES Constitutional and/or Bylaw Amendments If Any
6. Comments and Questions from the Floor:
   a) Membership Promotion (Membership Committee Chairman, Discussion Leader)
   b) Sustaining Member Promotion (Vice Chairman for Finance, Research Committee, Discussion Leader)
   c) Book Publishing (Publications Committee Chairman, Discussion Leader)
   d) Branch Educational Sessions (Chairman, Public Relations Committee, Discussion Leader)
7. AES National Conventions and Interim Meetings
   a) 1960 Los Angeles Convention (Los Angeles Convention General Chairman)
   b) Other AES National Conventions Ahead
   c) Seventh Interim Meeting, Philadelphia (General Chairman)
   d) Eighth Interim Meeting, Hartford (New England Region Representative)
   e) Report of Outcome of Golden Jubilee Convention and Industrial Finishing Exposition, including Fifth International Conference on Electrodeposition and Metal Finishing (Executive Board)
   f) Proposed Dates for AES's Next Industrial Finishing Exposition
8. New Business Brought For Discussion by Delegates
9. Announcement of Candidates for Third Vice Presidency
10. Adjournment

HISTORY OF PHILADELPHIA BRANCH AMERICAN ELECTROPLATERS' SOCIETY

ABOUT the year 1890, Mr. Charles H. Proctor conceived the plan of organizing a Society of foreman platers with the idea of putting the plating industry on a higher plane generally.

Through the columns of "Metal Industry", he appealed to foreman platers to support him. From May 1907, when Mr. Proctor first made his idea public at a speech in Philadelphia, organization moved rapidly. A charter was granted October 18, 1909 in New York, to the new group known as the National Electroplaters' Society of the United States and Canada. (It became AES in 1913).

In 1910 Philadelphia organized the first Branch of the new Society and at the first regular meeting of that Philadelphia Branch, Mr. F. C. Clements was elected President.

There were fourteen Charter Members:

F. C. Clements	R. Schofield	C. Bailer
J. Moore	A. Keiser	A. B. Wells
F. W. Buehler	A. Satories	P. Uhl
H. Hermans	J. Wilkinson	A. Heck
J. L. Dinan	W. Buckley	

♦

THIS first Philadelphia Branch meeting was held in the Hartford Sterling Company's building at 5th and Arch Sts. on September 30, 1910. Branch meetings were held at Dooner's Hotel, Broad St. & Ridge Ave. until 1914. Then through the efforts of S. D. Benoliel, privilege was given to hold meetings in the Harrison Laboratory of the University of Pennsylvania. The Philadelphia Branch appreciated this honor and from the results of our meeting at Harrison Laboratory, Dr. Hiram S. Lukens, of the University gave freely of his knowledge of chemistry to the members. This was our regular meeting place for 35 years. Dr. Lukens was made an Honorary Member of the AES.

From 1949 to 1954 the regular meetings were held at Mosebach's Restaurant at Germantown and Erie Aves. For many years the September meetings were held at the Broadwood Hotel.

Since 1954, the regular meeting place has been at the Engineer's Club at 1317 Spruce Street, Philadelphia.

♦

BECAUSE of our meeting at the University, Dr. A. K. Graham, then an instructor in chemistry at the University, became interested in the Society and in March 1924 began a series of lectures on the fundamental theory of electroplating chemistry. After having lectures for a year, the members became so interested in solution analysis that the Educational Committee secured a room and equipment at Kensington Evening High School. Here they met two nights each week starting in 1927.

In 1929, the Branch-sponsored class was moved to the Mastbaum Vocational Evening High School. Mr. Albert Hirsch directed two classes in chemical analysis and solution control, one night each week throughout the school term. Mr. Hirsch taught this class for 15 years. From 1944 to 1946 Mr. Edwin F. Ottens directed and taught the class, followed by Mr. Charles K. Goss, who taught from 1946 to 1950.

In 1950, through Philadelphia Branch efforts, the class meeting place was changed, this time to Temple University Technical Institute, under the direction of Dr. Samuel Heiman. The course now covers four semesters, each semester runs 15 Monday evenings. A certificate of Proficiency in Electroplating is granted by the University on completion of the four-semester course. Present enrollment is 41.

THE Philadelphia Branch has hosted three National Conventions to date, namely:

1919 at the Bellevue-Stratford Hotel

1932 at the Benjamin Franklin Hotel, Chairman George Gehling

1953 at the Benjamin Franklin Hotel, Chairman Dr. Samuel Heiman.

At the 1953 Convention the Philadelphia Branch started a tradition by having the first Sunday evening "Early Bird Party". The refreshments were punch and cookies baked by the Ladies Committee.

We have been honored by the American Electroplaters' Society in having the following serve as National Officers:

Presidents:

Mr. Philip Uhl	1921-1922
Mr. George Gehling	1930-1931
Mr. Frederick Fulforth	1940-1941
Dr. Samuel Heiman	1956-1957

Secretary-Treasurer:

Mr. George Gehling	1926-1930

National Executive Secretary:

Dr. A. Kenneth Graham	1945-1951

The Philadelphia Branch sponsored the Lancaster Branch, chartered in 1943, and the Reading-Allentown Branch, chartered in 1949.

During 1959-1960, Dr. Heiman is serving the American Electroplaters' Society as Chairman of the Publications Committee and is also on the Honorary Membership Committee. Mr. I. Wm. Marcovitch, Branch Secretary, is Chairman of the Electroplating Primer Sub-Committee of the Publications Committee. Mr. James E. Cogan, Branch President, is on the Membership Committee and Mr. Wm. H. Trusdell is on the Branch Exhibits Committee at our National Convention.

♦

THE Philadelphia Branch has always been blessed with strong leaders, as well as many faithful members and interested friends throughout our 50 years of organization. Branch Presidents have been:

1910-1913	F. C. Clements
1913-1914	A. B. Wells
1914-1915	Joseph L. Dinan
1915-1916	Samuel Barr
1916-1917	Wm. J. Bell
1917-1920	Otto W. Mott
1920-1921	D. A. Metz
1921-1929	George Gehling
1929- *	W. M. Scott (Died in office 12-3-1929)
1930-1931	Samuel T. Lunbeck
1931-1933	Harry Snyder
1933-1935	George M. Long
1935-1937	Albert Hirsch
1937-1940	Joseph E. Underwood
1942-1944	Nat. Verrelle
1944-1946	Eugene Zurbach, Jr.
1946-1948	Henry G. Orlik
1948-1949	Thomas M. Rodgers
1949-1951	Dr. Samuel Heiman
1951-1953	Alfred H. Pope
1953-1955	Edwin F. Ottens
1955-1957	Wm. H. Trusdell
1957-1959	Robert L. Farren
1959-	James E. Cogan, Jr.

We now have about 227 members and it is the feeling of the Branch that our best and most prosperous days still await us in the future.

Irvin K. Hauseman
I. Wm. Marcovitch
Dr. Samuel Heiman

BRANCH DIRECTORY*

(As at January 15, 1960)

ADELAIDE

Secretary-Treasurer: R. J. Down
13 Sedgeford Rd., Myrtle Bank, South Australia
Meeting Place: 17 Waymouth St., Adelaide
Day of Month: Various
Time: 6:00 P.M.
Sustaining Members:
None

ALLENTOWN-READING

Secretary-Treasurer: John B. Ernst
1531 "B" Liberty St., Easton, Pa.
Meeting Place: Scotty's Anchorage, Emmaus, Pa.
Day of Month: Fourth Thursday
Time: Dinner 7:30 P.M.
Sustaining Members:
Bethlehem Steel Co. (2), Bethlehem, Pa.
L. F. Grammes & Sons, Inc., Allentown, Pa.
The New Jersey Zinc Co. (of Pennsylvania), Palmerton, Pa.

BALTIMORE-WASHINGTON

Secretary: Edward J. Roach
1601 Woodbourne Ave., Baltimore 12, Maryland
Meeting Place: Chemistry Bldg., National Bureau of Standards, Washington 25, D. C.
and
The Regent House Hotel, Baltimore, Md.
Day of Month: Second Tuesday
Time: 8:00 P.M.
Sustaining Members:
Allied Research Products, Inc., Baltimore 5, Md.
American Instrument Co. Inc., Silver Spring, Md
E. I. duPont de Nemours & Co., Inc., Wilmington 98, Del.

BLUE RIDGE

Secretary-Treasurer: Robert H. Probert
2015 Roanoke Dr., Greensboro, N. C.
Meeting Place: Roanoke, Blacksburg, Blue View, Winston-Salem, Lynchburg, Carlton Terrace
Day of Month: First Friday
Time: 6:30 P.M.

BOSTON

Secretary-Treasurer: Dr. George P. Swift
53 Galen St., Watertown 72, Mass.
Meeting Place: Hotel Statler, Boston, Mass.
Day of Month: First Thursday
Time: Dinner 6:00 P.M.—Meeting—8:00 P.M.
Sustaining Members:
M. E. Baker Co., Cambridge, Mass.
Beacon Supply Co., Chelsea, Mass.
F. L. & J. C. Codman Co., Rockland, Mass.
United-Carr Fastener Corp., Cambridge 42, Mass.

BRIDGEPORT

Secretary-Treasurer: Robert G. Parker
25 Beverly Rd., Trumbull 58, Conn.
Meeting Place: Hotel Barnum, Bridgeport, Conn.
Day of Month: Second Friday
Time: 8:00 P.M.
Sustaining Members:
Electrolux Corp., Old Greenwich, Conn.
Mitchell-Bradford Chemical Co., Bridgeport, Conn.
Roberts Rouge Co., Stratford, Conn.
E. E. Seeley Co., Inc., Bridgeport, Conn.
Yankee Metal Products Corp., Norwalk, Conn.

BRITISH COLUMBIA

Secretary: Douglas A. Armstong
10316-124A Street, North Surrey, B.C.
Meeting Place: White Spot Barbecue, 25 & Cambie St. Vancouver, B. C.
Day of Month: 3rd Wednesday of Month
Time: 6:30 P.M.

BUFFALO

Secretary: Robert E. Lienert
44 Fancher Ave., Buffalo 23, N. Y.
Meeting Place: Niagara Manor, 899 Niagara Falls Blvd., Buffalo, N. Y.
Day of Month: 1st Friday
Time: 6:30 P.M. Dinner—Meeting 8:00 P.M.
Sustaining Members:
Van Der Horst Corporation of America, Olean, N. Y.

CAPITOL DISTRICT

Secretary: Edward O. Legere
100 Skyway Drive, Scotia, N. Y.
Meeting Place: Hot Shoppe, Albany, N. Y.
Day of Month: First Monday
Time: 7:00 P.M.
Sustaining Members:
Sprague Electric Co. North Adams, Mass.

CENTRAL MICHIGAN

Secretary-Treasurer: R. W. Boos
2400 E. Mt. Hope, Okemus, Micnigan
Meeting Place: Roosevelt Hotel, Lansing, Mich.
and
Hayes Hotel, Jackson, Mich.
Day of Month: First Tuesday
Time: 7:00 P.M. (Dinner Meeting)
Sustaining Members:
None

CHICAGO

Secretary-Treasurer: Paul Glab
882 N. Paulina St., Chicago 22, Ill.
Meeting Place: Stella's Restaurant, 3206 N. Kostner Ave., Chicago, Ill.
Day of Month: 2nd Friday of each Month
Time: Dinner 6:15—Meeting 7:15
Sustaining Members:
Acid Products Co., Inc., Chicago, Ill.
Allied Industrial Products, Inc., Chicago, Ill.
American Can Co., Maywood, Ill.
American Nickeloid Co., Peru, Ill.
Amerock Corporation, Rockford, Ill.
Amphenol Borg Electronics Corporation, Chicago 50, Ill.
Apex Plating Co , Chicago 7, Ill
Apollo Metal Works, Chicago 38, Ill
Ardco, Inc , Chicago 38, Ill.
Arrow Plating Co., Inc., Chicago 47, Ill.
Atlas Plating Works, Cicero 50, Ill.
Bastian Blessing Co., Chicago 30, Ill.
Belke Mfg. Co., Chicago, Ill.
Bell & Howell Co., Chicago 45, Ill.
Berteau-Lowell Plating Works, Chicago 47, Ill.
G. S. Blakeslee & Co., Cicero, Ill.
Chicago Electroplaters' Institute, Chicago 1, Ill.
Chicago Roller Skate Co., Chicago 24, Ill.
The Clinton Co., Chicago, Ill.
Croname, Inc., Chicago 13, Ill.
Crown Rheostat & Supply Co., Elk Grove Village, Ill.
The Diversey Corp., Chicago 13, Ill.
Duro Chrome of Chicago, Inc., Chicago 12, Ill.
Ekco Products Co., Chicago 39, Ill.
Electro-Glo Co., Chicago, Ill.
Felt & Tarrant Mfg. Co., Chicago 22, Ill.
General American Trans. Corp., Kanigen Div., Chicago 90, Ill.
Graham Plating Works, Chicago, Ill.
The C. P. Hall Co. of Illinois, Chicago, Illinois
Hardwood Line Mfg. Co., Chicago 47, Ill.
Industrial Filter & Pump Mfg. Co., Chicago 50, Ill.
Kaynide Div., Kraft Chemical Co., Chicago 8, Ill.
Kelite Corporation, Los Angeles, Calif.
Kocour Co., Chicago 32, Ill.
R. Lavin & Sons, Inc., Chicago 23, Ill.
Charles F. L'Hommedieu & Sons, Inc., Chicago 23, Ill.
M-W Laboratories, Inc., Chicago 47, Ill.
The Matchless Metal Polish Co., Chicago, Ill.
The Meaker Co., Chicago 50, Ill.
Mechanical Plating Co., Chicago 22, Ill.
Mercil Plating Equipment Co., Chicago, Ill.
B. Mercil & Sons Plating Co., Chicago 12, Ill.
Metalcraft Corp., Chicago 10, Ill.
Metalwash Machinery Corp., Barrington, Ill.
The Modern Plating Co., Chicago 18, Ill.
Modern Plating Corp., Freeport, Ill.
G. J. Nikolas & Co., Inc., Bellwood, Ill.
Northwestern Plating Works, Chicago 23, Ill.
Platers Technical Service, Inc., Chicago 5, Ill.
Plating Service Co., Chicago 39, Ill.

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* Numbers after names of Sustaining Members indicate number of memberships supported. This Directory is as of January 15, 1960.

Precision Electroplating Co., Chicago, Ill.
Poor & Company, Promet Division, Waukegan, Ill.
Reliable Plating Corp., Chicago 7, Ill.
Reliable Plating Rack Co., Schiller Park, Ill.
Scientific Control Laboratories, Chicago 23, Ill.
Sparkler Mfg. Co., Mundelein, Ill
Standard Plating Rack Company, Chicago 22, Ill.
The Stutz Company, Chicago, Ill.
Sunbeam Corp., Chicago 50, Ill.
Technic, Inc., Chicago 26, Ill.
Time Chemical, Inc., Chicago 32, Ill.
United Manufacturing Co., Chicago 18, Ill.
Van Streaten Chemical Co., Chicago, Ill.
Western Electric Co., Inc., Chicago 23, Ill.
Western Rust-Proof Co., Chicago, Ill.

CINCINNATI

Secretary: David L. Kaplan
817 Sabino Court, Cincinnati 31, Ohio
Meeting Place: Engineering Society Headquarters, Cincinnati
Day of Month: Fourth Wednesday
Time: Dinner 6:30 P.M.—Meeting 7:30 P.M.
Sustaining Members:
Products Finishing, Cincinnati, Ohio

CLEVELAND

Secretary-Treasurer: James K. Long
1945 E. 97th St., Cleveland 6, Ohio
Meeting Place: Cleveland Engineering Societies' Building
Day of Month: First Friday
Time: 8:00 P.M.
Sustaining Members:
Acme Plating Co., Cleveland, Ohio
Advance Plating Co., Cleveland, Ohio
Cowles Chemical Co., Cleveland, Ohio
Diamond Alkali Co., Chromium Chemicals Division, Cleveland 14, Ohio
Eaton Manufacturing Co., Cleveland 10, Ohio
Harshaw Chemical Co. (2), Cleveland, Ohio
Heil Process Equipment Corporation, Cleveland 11, Ohio
R. O. Hull & Co., Inc., Rocky River 16, Ohio
Incar, Inc., Cleveland 14, Ohio
The Kelly Plating Company, Cleveland, Ohio
Lorence Plating Co., Cleveland 4, Ohio
The McGean Chemical Co., Cleveland 9, Ohio
Pittsburgh Steel Co., Thomas Strip Div., Warren 14, Ohio
Platers Supply Co., Cleveland 14, Ohio
Republic Steel Corp., Cleveland, Ohio
Rockwell-Standard Corp., Newton Falls, Ohio
Talon, Inc., Meadville, Pa.
True Temper Corporation, Geneva, Ohio

COLUMBUS

Secretary: Leslie D. McGraw
3308 Sciotangy, Columbus, Ohio
Meeting Place: Battelle Memorial Institute, Columbus, Ohio
Day of Month: First Friday
Time: 8:00 P.M.
Sustaining Members:
None

DALLAS-FORT WORTH

Secretary-Treasurer: A. C. Fricke
212 Julian St., Dallas 3, Texas
Meeting Place: Zodiac Room, Crossroads Rest., Lennox Hotel, Grand Prairie, Texas
Day of Month: Third Wednesday
Time: 6:30 P.M.—Dinner—8:00 P.M.—Meeting
Sustaining Members:
None

DAYTON

Secretary Richard M. Clinehens
3206 Harwood St., Dayton 20, Ohio
Meeting Place: Hotel Dayton-Biltmore, Dayton, Ohio
Day of Month: Third Wednesday
Time: 8:00 P.M.
Sustaining Members:
Dayton Rust Proof Co., Dayton, Ohio
National Cash Register Co., Dayton, Ohio
Rack Processing Co., Dayton 9, Ohio
Rawac Plating Co., Springfield, Ohio

DENVER

Secretary: Philip London
3160 Dover Drive, Boulder, Colorado
Meeting Place: Oxford Hotel

DETROIT

Secretary-Treasurer: Guy Cummings Jr.
1800-18th St., Detroit Mich.
Meeting Place: Hotel Statler, Detroit, Mich.
Day of Month: First Friday
Time: 8:00 P.M.
Sustaining Members:
Auto City Plating Co., Detroit 17, Mich.
Bruce Products Corp., Howell, Mich.
Buckingham Products Co., Detroit 27, Mich.
Chrysler Corp. (2), Detroit, Mich.
Congress Die Casting Div. (Tann Corporation), Detroit 34, Mich.
Ford Motor Co. (5), Dearborn, Mich.
Formax Manufacturing Corp., Detroit, Mich.
General Motors Corporation, Research Staff (5), Detroit 2, Mich.
Grand Steel & Mfg. Co., Clawson, Mich.
C. M. Hall Lamp Company, Detroit 7, Mich.
Harshaw Chemical Co., Detroit, Mich.
Higgins Rack Coating & Mfg. Co., Warren, Mich.
Hoover Ball & Bearing Co., Saline, Mich.
Houdaille Industries, Inc., Detroit, Mich.
Howard Plating Industries, Inc., Royal Oak, Mich.
King-Seeley Corporation, Ann Arbor, Mich.
Lyon, Inc., Detroit 28, Mich.
Metal Plating Corp., Oak Park, Mich.
Metal & Thermit Corp., New York, N. Y.
Midwest Chrome Process Co., Detroit 9, Mich.
George L. Nankervis Co., Detroit 27, Mich.
Nelson Chemicals Co., Detroit 27, Mich.
Northwest Chemical Co., Detroit 4, Mich.
Oakman Manufacturing Co., Van Dyke, Mich.
Plating Inst. of Michigan, Lincoln Park, Mich.
Reilly Plating Company, Melvindale, Mich.
J. J. Siefen Co., Detroit 9, Mich.
Siefen Compounds, Inc., Detroit 38, Mich.
Solventol Chemical Products, Inc., Detroit 3, Mich.
Frederic B. Stevens, Inc. (2), Detroit 16, Mich.
Superior Polishing Company, Van Dyke, Mich.
Trilex Corporation, Wayne, Mich.
The Udylite Corp. (3), Detroit 11, Mich.
United Platers, Inc., Detroit, Mich.
Univertical Corporation, Detroit, Mich.
Wagner Division of Allied Research Products, Inc., Detroit 3, Mich.
Whitfield Chemical Co., Detroit, Mich.
Willow Run Rubber & Lining Co., Belleville, Mich.
Wyandotte Chemicals Corp., Wyandotte, Mich.

GRAND RAPIDS

Secretary: C. J. Byrns Jr.
1231 Fay Road, N.W., Grand Rapids, Mich.
Meeting Place: Scotties Restaurant-"Trader Room"
Day of Month: Second Friday
Time: 7:00 P.M.
Sustaining Members:
Abrado Finish Corporation, Grand Rapids, Mich.
Ainsworth-Precision Castings Co., Chicago 48, Ill.
Doehler-Jarvis Division of National Lead Company, Grand Rapids, Mich.
Expert Coating Co., Grand Rapids, Mich.
P. B. Gast & Company, Grand Rapids, Mich.
Grand Rapids Plating Co., Inc., Grand Rapids 5, Mich.
Grand Rapids Brass Co., Grand Rapids, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich
Hanson-Van Winkle-Munning Co., (formerly J. C. Miller Division) Matawan, N. J.
Haviland Products Company, Grand Rapids, Mich.
Jervis Corporation, Grandville, Michigan
Keeler Brass Co., Grand Rapids, Mich.
Knape & Vogt Mfg. Co., Grand Rapids, Mich.
Michigan Plating and Stamping Co., Grand Rapids 2, Mich.
Preston Products Co., Grand Rapids 4, Mich.
Roto-Finish Company, Kalamazoo, Mich.
Seaway Plating Co., Inc., Holland, Mich.
G. H. Walgren Company, Grand Rapids 3, Mich.

HAMILTON

Secretary: C. Ross MacLeod
40 W. 3rd St., Hamilton, Ontario, Canada
Meeting Place: Scotties Restaurant-"Trader Room"
Day of Month: Third Friday
Time: 8:15 P.M.
Sustaining Members:
Behr-Manning, Ltd., Brantford, Canada

HARTFORD

Secretary: Stanley Platoz
26 Erwin Place, New Britain, Conn.
Meeting Place: Hotel Bond, Hartford, Conn.
Day of Month: Third Monday
Time: 7:45 P.M.
Sustaining Members:
Arrow Hart & Hegeman Electric Company, Hartford 6, Conn.
W. D. MacDermid Chemical Co., Bristol, Conn.
Royal Typewriter Company, Hartford, Conn.
The Stanley Works, New Britain, Conn.

HOUSTON

Secretary-Treasurer: Harold Bartay
4313 Oleander, Bellaire 101, Texas
Meeting Place: Ram's Club Inc., 2710 Albany St., Houston, Texas
Day of Month: Third Tuesday
Time: 6:30 P.M.
Sustaining Member:
Dixie Electro Plating Company, Houston 3, Texas

INDIANAPOLIS

Secretary: Edna Rohrabaugh
1300 Burroughs St., Lafayette, Indiana
Meeting Place: Construction League, 1456 N. Delaware St.
Day of Month: First Tuesday
Time: Dinner 6:30—Meeting 8:00 P.M.
Sustaining Members:
Arvin Industries, Inc., Columbus, Ind.
Guide Lamp Division, General Motors Corp., Anderson, Ind.
Western Electric Company, Inc., Indianapolis 6, Ind.

KANSAS CITY

Secretary: Robert L. Garrett
3828 E. 9th Ter., Kansas City 27, Mo.
Meeting Place: Regan's Restaurant, 207 Southwest Blvd.
Day of Month: Second Thursday
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.
Sustaining Members:
None

LANCASTER

Secretary-Treasurer: George Geesey
317 East Poplar St., York, Pa.
Meeting Place: Varies
Day of Month: Second Friday
Time: 8:00 P.M.
Sustaining Members:
None

LOS ANGELES

Secretary: Harvey K. Hunt
2041 S. Davie Ave., Los Angeles 22, Calif.
Meeting Place: Roger Young Auditorium, 926 W. Washington Blvd., Los Angeles, Calif.
Day of Month: Second Wednesday
Time: 7:00 P.M.
Sustaining Members:
Ajax Hardware Mfg. Co., Los Angeles 32, Calif.
Alert Supply Company, Los Angeles 22, Calif.
Associated Plating Co., Los Angeles, Calif.
The Barber-Webb Co., Inc., Los Angeles 58, Calif.
Burton Silver Plating Co., Los Angeles, Calif.
L. H. Butcher Co., Los Angeles 23, Calif.
Crown City Plating Co., El Monte, Calif.
Hall Mack Company, Los Angeles 7, Calif.
McKesson & Robbins Inc., Los Angeles, Calif.
Modern Plating Co., Los Angeles, Calif.
George E. Nichols Plating, Los Angeles, Calif.
Peterson Plating & Processing Co., Glendale 1, Calif.
Price Pfister Brass Mfg. Co., Los Angeles 31, Calif.
Rheem Automotive Co., Fullerton, Calif.
Standard Nickel-Chromium Plating Co., Los Angeles, Calif.
Surface Alloys Engineering Co., Huntington Park, Calif.
Turco Products, Inc., Los Angeles 54, Calif.
Virtue Bros. Manufacturing Co., Los Angeles 45, Calif.

LOUISVILLE

Secretary-Treasurer: Charles C. Whitt
205 Saffell St., Lawrenceburg, Kentucky
Meeting Place: Hasenours Dining & Cocktail Lounge, 1028 Barrett Ave., Louisville, Kentucky
Day of Month: Third Thursday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.
Sustaining Members:
None

MELBOURNE

Secretary: I. W. Rose
41 Glen Orme Ave., Ormond S.E. 14, Melbourne, Victoria, Australia
Meeting Place: Metallurgy Theatre, Royal Melbourne Tech. College
Day of Month: Third Thursday
Time: 7:30 P.M.
Sustaining Members:
None

MIAMI

Secretary: Frank X. Marinello
5875 E. Fifth Ave., Hialeah, Florida
Meeting Place: 5000 East 10 Court, Hialeah
Day of Month: 3rd Friday
Time: 8:00 P.M.
Sustaining Members:
None

MILWAUKEE

Secretary-Treasurer: Frederick F. Padgett
4510 N. 22nd St., Milwaukee 9, Wis.
Meeting Place: Ambassador Hotel, Milwaukee, Wisc.
Day of Month: First Friday
Time: 8:00 P.M.
Sustaining Members:
Acme Galvanizing, Inc., Milwaukee 15, Wisc
Allen Bradley Co., Milwaukee 4, Wisc
Cutler-Hammer, Inc., Milwaukee, Wisc.
Donald Sales & Mfg. Co., Milwaukee 13, Wisc.
Kohler Co., Kohler, Wisc.
Milwaukee Plating Co., Milwaukee 12, Wis.
John Oster Mfg. Co., Milwaukee 17, Wisc.
Racine Plating Co., Inc., Racine, Wisc.
Square D Company, Milwaukee 12, Wisc.
S. K. Williams Co., Milwaukee 10, Wisc.

MISSISSIPPI VALLEY

Secretary-Treasurer: Clyde N. Shepherdson
1385 Moshier Ave., Galesburg, Ill.
Meeting Place: Moline American Legion Hall, Moline, Ill.
Day of Month: Third Wednesday
Time: 8:00 P.M.
Sustaining Members:
Victor Casket Hardware Co., Galesburg, Ill.

MOHAWK VALLEY

Secretary-Treasurer: Henry J. Crouse
1414 Taylor Ave., Utica 3, N. Y.
Meeting Place: Thompson's Hotel, Yorkville, N. Y.
Day of Month: Second Thursday
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.
Sustaining Members:
None

MONTREAL

Secretary-Treasurer: R. W. Niggeman
c/o Empire Buff Co., Ltd., 99 College St., Montreal 30, Quebec, Canada
Meeting Place: Sheraton Mount Royal Hotel, 1455 Peel St., Montreal, P. Q.
Day of Month: Second Monday
Time: 8:30 P.M.
Sustaining Members:
Alloycraft, Ltd., Westmont, Montreal, Canada
Northern Electric Co., Ltd., Montreal, Quebec, Canada

NEWARK

Secretary: D. Gardner Foulke
455 Johnston Drive, Watchung, RFD 3, Plainfield, N. J.
Meeting Place: Robert Treat Hotel
Day of Month: Third Friday
Time: 8:15 P.M.
Sustaining Members:
American Smelting & Refining Co., South Plainfield, N. J.
Bell Telephone Laboratories, Murray Hill, N. J.
Frederick Gumm Chemical Co., Kearny, N. J.
Hanson-Van Winkle-Munning Co. (2), Matawan, N. J.
Hy Grade Electro Plating Co., Newark 7, N. J.
International Nickel Company, Inc. (2), Bayonne, N. J.
Maas & Waldstein Co., Newark 4, N. J.
Sel-Rex Corporation, Nutley 10, N. J.

NEW HAVEN

Secretary-Treasurer: Bernard J. Gaffney
40 Filbert St., Hamden, Conn.
Meeting Place: New Haven Motor Inn
Day of Month: Second Tuesday
Time: 8:00 P.M.
Sustaining Members:
Christie Plating Company, Groton, Conn.
Chromium Process Co., Shelton, Conn.
Corona Corporation, Jersey City 5, N. J.
Enthone, Inc., New Haven 2, Conn.
Lycoming Div., AVCO Mfg. Corp., Stratford, Conn.

NEW YORK

Secretary-Treasurer: Milton Nadel
9-05 162nd St., Whitestone 57, N. Y.
Meeting Place: Hotel Statler
Day of Month: Second and Fourth Fridays
Time: 8:00 P.M.

Sustaining Members:
Allied Chemical Corp., Solvay Process Div., Syracuse 1, N. Y.
Allied Chemical Corp., National Aniline Div., New York 6, N. Y.
American Zinc Institute, New York, N. Y.
International Nickel Company, Inc. (3), New York, N. Y.
Lea-Ronal, Inc., Jamaica 35, N. Y.
Levco Metal Finishers, Inc., Long Island City 1, N. Y.
Metal & Thermit Corp., New York 17, N. Y.
Metals & Plastics Publications, Inc., Westwood, N. J.
Oakite Products, Inc., New York 6, N. Y.
Photocuits Corporation, Glen Cove, N. Y.
Sylvania Electric Products, Inc., Flushing, N. Y.

PHILADELPHIA

Secretary: I. William Marcovitch
1302 St. Vincent St., Philadelphia 11, Pa.
Meeting Place: Engineers' Club of Philadelphia, 1317 Spruce St., Philadelphia 7, Pa.
Day of Month: Fourth Monday
Time: 8:00 P.M.

Sustaining Members:
Accurate Electro-Plating, Inc., Philadelphia, Pa.
Aetna Electroplating Co., Inc., Philadelphia 11, Pa.
American Chemical Paint Co., Ambler, Pa.
General Plating Co., Trenton, N. J.
Leeds & Northrup, Philadelphia 44, Pa.
Pennsalt Mfg. Co., Philadelphia, Pa.
Philadelphia Rust Proof Co., Philadelphia 34, Pa.
Progress Mfg. Co., Inc., Philadelphia 34, Pa.
Radio Corporation of America, Camden 2, N. J.
The Reynolds Co., Philadelphia 32, Pa.

PHOENIX

Secretary: James Weaver
6802 Paradise Parkway, Scottsdale, Arizona
Meeting Place: Armed Services Officers Club
3334 East Camelback, Phoenix.

PITTSBURGH

Secretary: Edward B. Keller
1102 Sunday St., Pittsburgh 12, Pa.
Meeting Place: Gateway Plaza, Pittsburgh, Pa.
Day of Month: Second Wednesday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:
Aluminum Company of America, New Kensington, Pa.
Rockwell-Standard Corp., Standard Steel Spring Div., Coraopolis, Pa.
Weirton Steel Co., Weirton, West Va.
Westinghouse Electric Corp., East Pittsburgh, Pa.

PORTLAND

Secretary-Treasurer: George Bethell
L. H. Butcher Co., 2750 N. W. 31st, Portland, Oregon
Meeting Place: Various
Day of Month: Open
Time: 6:30 P.M.

Sustaining Members:
None

PROVIDENCE-ATTLEBORO

Secretary: Dr. Edward A. Parker
Technic Inc., P. O. Box 965, Providence, R. I.
Meeting Place: Providence Engineering Society Building, 195 Angell St., Providence, R. I.
Day of Month: Third Monday
Time: 8:00 P.M.

Sustaining Members:
Gorham Manufacturing Co., Providence 7, R. I.
Walton & Lonsbury, Attleboro, Mass.

ROCHESTER

Secretary-Treasurer: Barrie M. Gardner
129 Ridgewood Rd., Rochester 15, N. Y.
Meeting Place: Rochester German Club, Rochester, N. Y.
Day of Month: First Monday
Time: 8:00 P.M.

Sustaining Members:
Eastman-Kodak Co. (2), Rochester 4, N. Y.
Stromberg-Carlson Co., Rochester, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Wollensak Optical Co., Rochester, N. Y.

ROCKFORD

Secretary-Treasurer: E. J. Budden
122 12th St., Rockford, Ill.
Meeting Place: Faust Hotel, Rockford, Ill.
Day of Month: Second Monday
Time: 7:00 P.M.

Sustaining Members:
National Lock Co., Rockford, Ill.

SAGINAW VALLEY

Secretary-Treasurer: George Savage
2921 Concord, Flint 4, Mich.
Meeting Place: Zehnder, Frankenmuth, Michigan
Day of Month: Second Wednesday
Time: 6:45 P.M.

Sustaining Members:
American Buff Co., Chicago 16, Illinois

ST. JOSEPH VALLEY

Secretary: Henry A. Meers
2001 Bergan St., South Bend, Ind.
Meeting Place: Lincoln Highway Inn, Mishawaka, Ind.
Day of Month: First Wednesday
Time: 7:00 P.M.

Sustaining Members:
Bendix Aviation Corp., Bendix Prods. Div. South Bend 20, Ind.
Inland Chemical Corporation, Fort Wayne, Ind.
Rockwell-Standard Corp., Mishawaka, Ind.
Roth Plating Corporation, South Bend, Ind.
South Side Plating Works, Inc., Elkhart, Ind.
Standard Plating Works, Inc., Goshen, Ind.
The Studebaker-Packard Corp., South Bend, Ind.

ST. LOUIS

Secretary: Ward W. Kelly
7046 Deerpath Drive, St. Louis 23, Mo.
Meeting Place: York Hotel, Sixth St. & Market St. St. Louis, Missouri
Day of Month: Second Wednesday
Time: Dinner 6:45 P.M.—Meeting 8:00 P.M.

Sustaining Members:
American Zinc Sales Co., St. Louis, Mo.
Bussman Mfg. Co., St. Louis, Mo.
Chandeysson Electric Co., St. Louis, Mo.
Davies Supply & Mfg. Co., St. Louis 16, Mo.
Folding Carrier Corp., Oklahoma City, Okla.
C. Hager & Sons Hinge Mfg. Co., St. Louis 5, Mo.
Knapp-Monarch Co., St. Louis 16, Mo.
Lasalco, Inc., St. Louis 4, Mo.
Maurer Supply Co., St. Louis, Mo.
National Rejectors, Inc., St. Louis 15, Mo.
G. S. Robins Co., St. Louis 2, Mo.
Sommers Brothers Mfg. Co., St. Louis 7, Mo.

SAN FRANCISCO

Secretary-Treasurer: C. E. Snelgrove
c/o L. H. Butcher Co., 15th & Vermont Sts., San Francisco, Calif.
Meeting Place: International Inn, South San Francisco, Calif.
Day of Month: Second Thursday
Time: 7:00 P.M.

Sustaining Members:
Schlage Lock Co., San Francisco 19, Calif.
Wildberg Bros. Smelting & Refining Co., San Francisco 2, Calif.

INDICATE A 223 ➤

LEA

ABRASIVE FINISHING METHODS

NICKEL and NICKEL ALLOYS

STAMPINGS • CASTINGS • FORGINGS • FORMINGS • DIE CASTINGS

Pure nickel and the high nickel alloys may be finished to any of the mechanically produced effects obtainable on white metal, ranging from a sand blast finish to the high lustrous mirror finish. A satin finish can be produced with fewer operations and very much less time than is required for a high lustre polish. No short cuts for developing a desired effect are possible. A "base" from which all surface defects have been removed must be produced and on this the finish is developed. The coarser the abrasive required to produce this "base", the more operations required to produce the desired finish. Each subsequent operation must remove the wheel marks produced by the preceding operation.

Nickel Silver, because of the quantity used in the metal industry, must be considered as one of the most important of the nickel alloys. However, because of its high copper content and tendency to tarnish, it is seldom used by itself but generally as a base metal for subsequent electrodeposits. It is much easier to machine and abrade than harder nickel alloys and responds more readily than the higher nickel alloys to cut-down buffing.

Nickel is one of the most important metals applied by electrodeposition and the finishing of nickel plate will be covered separately.

POLISHING... Recommended polishing speeds for nickel alloys are about 6500 to 7500 sfm. Recommended wheels are sewed buffs, felt, canvas and leather polishing wheels, coated with **Leabrament** or **Plasti-Brade** (liquid abrasive compositions). If loose abrasives are used for preparing polishing wheels, **Gripmaster** or **Plasti-Glue** polishing wheel cements should be used.

INTERMEDIATE FLEXIBLE POLISHING... To remove small defects, flash, etc. and produce a uniform finish, use **Grade "C"** or **Grade "N" Lea Compound** on sewed buffs at 6000 sfm. A special application of this is in the edging of nickel silver flatware immediately after trimming. For this, **Grade "C" Lea Compound** is used on an 8" diameter, 6" face packed muslin buff at 2400 rpm.

SATIN FINISHING... For the production of a satin finish, **Grade "N" Lea Compound** is recommended on a high count full-disc muslin buff at 5500 sfm. Finer and coarser grades of **Lea Compound** are available.

BRIGHT FINISHING—Bar Compositions... To prepare the surface of nickel silver for plating, it is generally given a cut-down buffing operation with a Tripoli composition such as **Grade 765 Learok** on a pocketed or ventilated buff at about 8000 sfm.
To produce a bright finish on high nickel alloy base metals, the following procedure has been used to advantage: cut-down buffing with **Grade 316 Learok** on a loose muslin buff at 7500 sfm; then color buff on the same type of wheel and at the same speed using **Grade 302-C Learok.**

BRIGHT FINISHING — Liquid Compositions... For **cutting down** operations use **Grade TH52P Liquabrade.** For **coloring operations** use **Grade UF47J Liquabrade.** For **high coloring** use **Grade UH20A Liquabrade.** Buffs and speeds for use with **Liquabrade** are the same as for Bar Compositions.

BUTLER FINISHING... Butler Finishing is carried out after bright finishing with **Grade "B-12"** and **Grade "MH" Lea Compound** at about 5000 sfm.

ABRASIVE FINISHING
NICKEL and NICKEL ALLOYS

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions. Manufacturers of Lea Compound and Learok . . . Industry's quality buffing and polishing compounds for over 30 years.

The Hallmark of Quality Products

THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.

Lea-Michigan, Inc., 14459 Wildemere Ave., Detroit 38, Mich.
Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, Derbyshire, England
Lea-Ronal, Inc., Main Office and Laboratory: 139-20 109th Ave., Jamaica 35, N. Y.
Manufacturing Plant: 237 East Aurora St., Waterbury 20, Conn.

Are you interested in plating specimens? SEE THE OTHER SIDE OF THIS INSERT

Tailored cyanide copper processes

...*there's a specific Lea-Ronal copper process to meet your own exacting requirements*

Over the years Lea-Ronal has gained world-wide recognition for its research on cyanide copper plating. From this research and development have come numerous processes, each with its own characteristics that make it outstanding for a specific type of operation. Every member of this Lea-Ronal family of Cyanide Copper Processes has been thoroughly production-tested and has been instrumental in improving the quality and production of the user's plating operation.

Any order for a Lea-Ronal Process carries with it plus values in experienced technical service and know-how.

The LEA GROUP
serving the Finishing Field
Lea-Ronal, Inc., Jamaica, N. Y.
Lea-Michigan, Inc., Detroit
The Lea Mfg. Co., Waterbury, Conn.
Lea Mfg. Co., of Canada, Ltd.
Lea Mfg. Co., of England, Ltd.
Plating Polishing Buffing Burring

Lea-Ronal Inc.

Sales and Manufacturing Plant:
237 East Aurora Street, Waterbury 20, Conn.
Main office and Laboratory:
139-20 109th Avenue, Jamaica 35, N. Y.

for bright high speed copper

COPPER-GLO

For plating buffed zinc die castings or steel where maximum leveling or hiding is not a factor.

A full bright high speed cyanide copper that has become the industry standard. Through continued research this process has been constantly improved to give trouble free bright high speed operation.

for buffable copper

CUPRALL

A lustrous, ductile, buffable copper than can be plated at high speeds. Because of these characteristics and its exceptional tolerance to impurities, this bath has become the standard for such operations as bumper refinishing.

for hiding imperfections

Q-STRIKE

A cyanide copper strike developed to aid in "hiding" surface imperfections that are not covered by conventional strikes or bright copper processes. Will increase hiding and leveling when used as a strike prior to bright nickel.

for micro-leveling and lustre

Q-LEVEL

A new improved economical and simple cyanide copper process that offers a definite degree of leveling or hiding without employing current reversal cycles. Imperfections in castings can be partially or completely hidden (Leveling is achieved on surface roughness not exceeding 10 RMS).

for high rates of deposition plus micro-leveling

AIR-Q-LEVEL

A Q-Level Bath specifically designed for air agitation. Offers all the advantages of the Q-Level Process plus increased rates of deposition, and excellent metal distribution.

for leveling plus high rates of deposition

PR-Q-LEVEL

A Q-Level Bath designed to operate with Periodic Reverse. In addition to the high rates of deposition, macro-leveling as well as micro-leveling can be achieved. Process is simple, economical, completely stable with no deterioration of brighteners over prolonged operating periods.

WRITE OR PHONE:

THE LEA MANUFACTURING CO. 16 CHERRY AVE., WATERBURY 20, CONN.

THROUGH WHOM THESE CYANIDE COPPER PROCESSES ARE EXCLUSIVELY MARKETED.

Note: The above Lea-Ronal Cyanide Copper Processes are covered by patents or pending patents.

Are you interested in Buffing, Polishing and Burring Specialties? **SEE OTHER SIDE OF THIS INSERT.**

SEATTLE-PUGET SOUND

Secretary: Mrs. Helen Archibald
17814 Palatine, Seattle, Wash.

Meeting Place: Andy's Diner, Seattle, Wash.

Day of Month: Third Tuesday (Flexible)
Time: 7:00 P.M.—Meeting 8:00 P.M.

Sustaining Members:
Kaiser Aluminum & Chemical Corp. Spokane, Wash.

SOUTHEASTERN

Secretary-Treasurer: H. R. Stogner Sr.
2631 Tilson Road, Decatur, Georgia

Meeting Place: Belmont Steak House, Downtown Luckie St., Atlanta, Ga.

Day of Month: Second Friday
Time: 7:30 P.M.

Sustaining Member:
Production Plating Company, Adel, Ga.

SOUTHERN TIER

Secretary: Bill Rossiter
5 Ellen St., Rt. 97, Binghamton, N. Y.

Meeting Place: Carlton Hotel, Binghamton, N. Y., and Pierce's Restaurant, Elmira, N.Y.

Day of Month: Third Tuesday
Time: 7:15 P.M.

Sustaining Members:
International Business Machines Corp., Endicott, N. Y.

SPRINGFIELD

Secretary: Henry L. Heissfeld
74 Chilson St., Springfield, Mass.

Meeting Place: Blake's Restaurant, 15 Market St., Springfield, Mass

Day of Month: Fourth Monday
Time: Dinner 7:00 P.M.—Technical Session 8:00 P.M.

Sustaining Members:
The Chemical Corporation, Springfield, Mass.
Moore Drop Forging Co., Springfield, Mass.

SYDNEY

Secretary-Treasurer: M. R. MacKinnon
3 Hyde Brae St., Strathfield, New South Wales Australia

Meeting Place: Theatrette, Sydney Technical College, Harris St., Ultimo, Sydney

Day of Month: Second Wednesday
Time: 7:30 P.M.

Sustaining Members:
None

SYRACUSE

Secretary: Robert A. Carpenter
138 Oakland St., Syracuse, N. Y.

Meeting Place: Turn Hall, 619 N. Salina St., Syracuse, N. Y.

Day of Month: Third Monday
Time: Dinner 6:45 P.M.—Meeting 8:00 P.M.

Sustaining Members:
Oneida, Ltd., Oneida, N. Y.

Special Contributions to Research Fund, (1959-1960): American Society for Testing Materials. Foreign Sustaining Members: Ingalco S. R. L. Co., Buenos Aires, Argentina.

TOLEDO

Secretary-Treasurer: Ben Gomersall
6015 Anthony Wayne Trail, Route 1, Maumee, Ohio

Meeting Place: Angelo's Spaghetti House, Stickney Ave., Toledo, Ohio

Day of Month: First Thursday
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.

Sustaining Member:
The Electric Auto-Lite Co. (2), Sharonville 8, Ohio

TORONTO

Secretary: R. H. Clark
262 Woburn Avenue, Toronto, 12, Ontario, Canada

Meeting Place: Royal York Hotel, Toronto, Ontario, Canada

Day of Month: Second Friday
Time: Dinner 6:30 P.M.—Meeting 8:15 P.M.

Sustaining Members:
Armalite Company, Ltd., Toronto, Ontario, Canada
British Chrome & Chemicals (Canada) Ltd., Toronto 5, Ontario, Canada
Canada Cycle & Motor Co., Ltd., Weston, Ontario, Canada
Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario, Canada
Canadian Motor Lamp Company Ltd., Windsor, Ontario, Canada
Houdaille Industries of Canada, Ltd., Oshawa, Ontario, Canada
International Business Machines Co., Toronto 6, Ontario, Canada
International Nickel Co. of Canada, Ltd., (3) Toronto, Ontario, Canada
Lea Manufacturing Co. of Canada, Ltd., Scarborough, Ontario, Canada
Metal & Thermit—United Chromium of Canada, Ltd., Rexdale, Ontario, Canada
W. W. Wells, Ltd., Scarborough, Ontario, Canada

WATERBURY

Secretary-Treasurer: James R. Kennedy
Risdon Mfg. Co., P. O. Box 32, Waterbury 20, Conn.

Meeting Place: Colonial Room, Roger Smith-Elton Hotel

Day of Month: Second Thursday
Time: Dinner 6:30 P.M.—Meeting 8:30 P.M.

Sustaining Members:
American Brass Company, Waterbury 20, Conn.
American Chemical & Refining Co., Waterbury, Conn.
Apothecaries-Hall Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chromium Corporation of America, New York, N. Y.
Harper Leader, Inc., Waterbury 20, Conn
The International Silver Co., Meriden, Conn.
The Lea Mfg Co., Waterbury 20, Conn.
Lux Clock Manufacturing Co., Waterbury, Conn
MacDermid, Inc., Waterbury 20, Conn.
The Patent Button Co., Waterbury 2, Conn.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
The Summit Finishing Co., Inc., Thomaston, Conn.
Wallace Silversmiths, Inc., Waterbury, Conn.
The Waterbury Plating Co., Waterbury 86, Conn.
Whyco Chromium Co., Inc., Thomaston, Conn.

WESTERN ONTARIO

Secretary-Treasurer: Robert Dobson
Box 41, Watford, Ontario, Canada

Meeting Place: William Pitt Hotel, Chatham, Ontario, Canada

Day of Month: Third Friday
Time: 6:30 P.M.—Dinner-Meeting

Sustaining Members:
Bendix Eclipse of Canada, Ltd., Windsor, Ontario, Canada
General Motors of Canada, Ltd., Oshawa, Ontario, Canada
Ontario Steel Products Co., Ltd., Chatham, Ontario, Canada

WICHITA

Secretary: Richard Bartholomew
2029 Ohio, Augusta, Kansas

Meeting Place: Oriental Restaurant, 5405 E. Central, Wichita, Kas.

Day of Month: Fourth Wednesday
Time: 6:30 P.M.

Sustaining Members:
None

◀ INDICATE A 224.

INTERSOCIETY NEWS

MFSA TRUSTEES MEET IN NEWARK

The board of trustees of the Metal Finishing Suppliers' Association and members of its various committees held that body's annual Eastern Interim Meeting at the Hotel Robert Treat in Newark, N. J. on the afternoon of December 12, 1959 with President Ray Ledford presiding. Progress reports were given by officers and committee chairmen, and there was discussion of old and new business with action subject to ratification at the Board's midwest meeting, to be held in Chicago on January 30, 1960.

Those in attendance included R. F. Ledford, Chicago, president; J. G. Carrique, Montreal, second vice president; H. L. Kellner, New Haven, third vice president; E. A. Blount, Cincinnati, treasurer; E. W. Couch, Waterbury, past president; A. P. Munning, Newark, executive secretary; E. L. Combs, Cleveland, H. J. McCracken, Detroit, R. M. Norton, Matawan and J. E. Trumbour, Westwood, trustees; M. Glover, Boston and J. Duffy, Philadelphia, committee chairmen.

Following adjournment the group attended a cocktail party cooperatively hosted by Enthone, Inc., Frederick Gumm Chemical Co. Inc., Hanson-Van Winkle-Munning Co., Sel-Rex Corporation, and Udylite Corporation, under the auspices of the MFSA. Later, an enjoyable evening was spent at the annual Christmas Party of the Newark Branch of the AES attended by approximately 375 people.

♦

TWO COMMITTEES ANNOUNCED BY NAMF

Two key committees of the National Association of Metal Finishers have been named. They include the educational and the standard and ethical practices committees, headed by Edward N. Marlette, Marlette Plating Co., Buffalo and John T. Hyduke, Durable Plating Co., Cleveland, respective chairmen.

The educational committee is responsible for over-all educational activities of the association, including the Management Manual project, and surveys on operating costs and wage and salary structures. Industry practices, trade customs, and the formulation of an industry code of ethics are the responsibility of the standard and ethical practices committee.

The educational committee is composed of Edward N. Marlette, chairman; Glenn H. Friedt Jr., United Platers, Inc., Detroit, vice chairman; A. T. Leonard, Superior Plating, Inc., Minneapolis; William R. Crawford, Chrome-Rite Co.; Chicago; William Carlson, Arrow Plating Co., Chicago; and Jules Horelick, Allied Metal Finishing Co., Baltimore.

The members of the standard and ethical practices committee are John T. Hyduke, chairman; Stephen P. Palisin, Empire Plating Co.; Raymond Kuehne, General Hard Chrome Co.; Duke L. Saas, Atlas Hard Chrome Service; Joseph Kopernak, J & R Plating and Polishing Co.; William J. Higgins, Manufacturers' Plating Co.; and William J. Karkut, Dun-Well, Inc.; all of Cleveland.

♦

PLATERS FORUM HELD IN HOLLAND

On November 12, 1959 Plating-Chemie N.V.'s Hertogenbosch (Holland) conducted a Platers Forum in the Esplanade Theatre in Utrecht. A panel of experts from home and abroad replied to questions on electroplating.

Members of the forum panel were: Mr. Bache, chief chemist, Efco-Udylite, England; R. Corbiere, director, Ets. R. Corbiere, Brussels; A. Geelen, Plating-Chemie N.V.; B. Grootenhuis, Plating-Chemie N.V.; Mr. Metzger, chief chemist, Messrs. Blasberg, Solingen (Germany); Dr. J. M. Odekerken, director, Plating-Chemie N.V.; Rene Rochat, vice president, Sel-Rex Corporation, European Branch, Geneva; F. Studer, director, Colasit A. G., Wimmis, Switzerland.

P. W. Meuldijk, assistant director, Plating-Chemie N.V., acted as quizmaster and was the liaison between the forum and the questioners.

Besides technical people of almost all large factories in The Netherlands which apply 'galvano technics,' the following were in the auditorium: P. Borghardt, chief editor "Galvanotechniek"; W. Voncken, managing director "Galvanotechniek;" William Zwerner, manager of manufacturing, Sel-Rex Corporation, European Branch, Geneva; Mr. Ades, assistant-director, Messrs. Parker, Paris; J. Corbiere, director, Ets. R. Corbiere, Brussels; Mr. Diesbergen, manager, Colasit-Galvanotechnik, Wimmis, Switzerland.

The questions concerned the whole field of electroplating. Special attention was drawn to the newest bright nickel bath, and to the newest developments in duplex chrome and the sandwich—chrome-nickel-chrome—which are claimed to increase 10 to 20 times the corrosion resistance of the coating.

Three films were shown: (1) Operation Giant, a Ford film about the biggest automatic plating machine in the world. (2) Installation Report No. 1, a color film on the bright-nickel chrome automatic machine at Messrs. Fiat in Milan. (3) Plating Automatically, a color film about the principle and the construction of an Efco-Udylite automatic plating machine.

(LEFT) Dr. J. M. Odekerken opening the Holland Platers Forum. The other members of the panel are shown at the dais. (RIGHT) A few of the platers who filled the theatre's auditorium.

ASM NEW LITERATURE SEARCHING SERVICE

A new, electronic metallurgical searching service with a 100,000 titles-per-hour capacity will be launched early this year by the American Society for Metals, Novelty, Ohio.

The new facility, to be known as the ASM Metals Documentation Service, was announced at the society's annual meeting. It will supply subscribers with titles and information about documents reporting on any aspect of metallurgical science, engineering, and the fabrication and use of metal parts that appear in the world's literature.

The pilot program was conducted under ASM sponsorship at the Center for Documentation and Communication Research of Western Reserve University, Cleveland, Ohio. A grant of $75,000 by the Metal Society financed the experimental work.

When in operation the new searching machine will be able to search 100,000 indexed documents per hour and print out titles and sources of those pertinent to the subscriber's need.

♦

TOOL SHOW TO BE HELD IN DETROIT

More than 900 new ways to increase productivity in America's metalworking plants will be premiered at the American Society of Tool Engineers' 1960 Tool Show in Detroit, April 21 to 28.

The exposition at the Detroit Artillery Armory will contain over 6000 examples of up-to-date machines, tools and manufacturing equipment worth $15,000,000.

According to a survey taken recently by the Society among the 530 exhibitors, 1300 products to be displayed are new in the last year.

♦

ZEILE NAMED LEGAL COUNSEL FOR NAMF

G. David Zeile Jr., of the law firm of Ashman, Zeile and Portmann, Cleveland, Ohio, has been named legal counsel for the National Association of Metal Finishers. This announcement was made recently by A. T. Leonard, NAMF president.

Attorney Zeile reportedly rendered important counsel in the current Pennsylvania job printing industry court case. Since 1953, he has been executive secretary of the Ohio Association of Metal Finishers.

♦

DESIGN ENGINEERING SHOW AT NEW YORK COLISEUM IN MAY

The Design Engineering Show, an exposition devoted to the research and development of new products, will occupy all four floors of the New York Coliseum during a four-day run there, May 23 to 26.

Three hundred and seventy-five nationally known companies already have contracted for exhibit space and it is expected that the final number will be well over 400.

During the same four days, the machine design division of the American Society of Mechanical Engineers will sponsor its annual Design Engineering Conference also at the Coliseum. The show is one of the largest industrial expositions in the country. More than 20,000 major executives and engineers are expected to attend.

On exhibit will be hundreds of metal alloys, plastics, synthetic and natural rubbers, power transmission equipment, electrical and electronic components, mechanical components, various shapes and forms, fasteners and adhesives, finishes and coatings, hydraulic and pneumatic components, engineering equipment and services, and almost everything else which goes into the making of industrial or consumer end products.

NEW SPE STAFF MEMBER

Robert D. Forger has received appointment as administrative assistant on the national office staff of the Society of Plastics Engineers. Mr. Forger's primary responsibility will be the implementation of the Society's recently expanded public relations program. He will also work closely with the 44 local sections and provide staff assistance to committees handling technical meetings of the society.

Mr. Forger graduated from Norwich University in 1949 with a BS in chemistry. He served on the staff of Dorr-Oliver Inc. of Stamford for over ten years as a research and development engineer, in their advertising and public relations departments and as manager of technical publicity. He is a member of the American Institute of Chemical Engineers.

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INDUSTRY NEWS

Ford Ballantyne, right, general manager of the J. B. Ford Division and a Wyandotte Chemicals' vice president and director, presenting to District Sales Manager Charles Martin in behalf of his men the engraved trophy award for "outstanding performance in 1959."

NEW TECHNICAL CENTER AND PLANT FOR PENNSALT

Pennsalt Chemicals Corp. has concluded negotiations to purchase a 50-acre site in the King of Prussia Park, Pennsylvania, for construction of a technical center which will ultimately represent an investment of $6,000,000. This Park is located at the Valley Forge Interchange of the Pennsylvania Turnpike.

Plans call for a campus-type arrangement featuring a central mall. The first building will be a two-story laboratory occupying approximately 21,000 sq ft. This will be devoted to product development and technical service on Pennsalt's proprietary chemicals for the metal working and other industries.

Pennsalt will also invest about $500,000 in a new plant at Atlanta, Georgia. Scheduled to go on stream in the Spring of 1960, the Atlanta plant will be the seventh unit devoted to production of Pennsalt specialties added in the past five years.

The Atlanta plant will be constructed on a ten acre site served by a direct rail spur and express highway permitting fast service to area customers. A modern one-story structure, it will provide production and warehousing facilities for Pennsalt's chemical products.

CORRECTION

Figures 3 and 4 on p. 1155 of PLATING, October 1959, are transposed in the paper "Progress Toward the Development of a Nonembrittling Cadmium Electroplating Process. III. The Use of Triethanolamine in Cadmium Plating Solutions" by P. N. Vlannes, S. W. Strauss and B. F. Brown. The illustration in Fig. 3 is that for Fig. 4 and vice versa.

WORKLON OPENS WESTERN OFFICE

Worklon, Inc. has announced the opening of a western branch office at 1007 Madison Avenue, Los Angeles, California.

Worklon's Los Angeles office will be headed by Marvin Maltz and will carry complete stocks.

EXPANSION AT RAMPE PLANT

A 100 per cent plant expansion has been started by Rampe Manufacturing Co. on its present factory site at 14915 Woodworth Avenue, Cleveland 10, Ohio. The enlarged facilities, doubling present factory space, will provide room for a three-fold production increase in the near future. The company, long a producer of barrel-finishing equipment, including related motor drive components, recently introduced several new multi-ton machines and has added wider national sales distribution. It is expected that the new plant expansion will be completed early this year.

STEVENS DISTRIBUTOR FOR WYANDOTTE IN THREE STATES

Wyandotte Chemicals Corp., J. B. Ford Division, has announced the appointment of Frederic B. Stevens, Inc., as a distributor for Wyandotte metal cleaning and finishing products in the States of Michigan, Ohio and Indiana.

Stevens, 76 year old Detroit concern, has its main office at 1800 18th street. Stevens will maintain a complete stock of Wyandotte metal cleaning and finishing products at its warehouse facilities in the three state area it will serve.

UDYLITE HAS LARGER QUARTERS IN PHILADELPHIA-CAMDEN AREA

A fully equipped laboratory for analysis of electroplating solutions is part of the new warehouse and office facilities of the Udylite Corp. serving platers in the Philadelphia-Camden area of Pennsylvania and New Jersey.

The new address for the Udylite regional branch is 1400 Suckle Highway in Pennsauken, New Jersey, a suburb of Camden. A branch office was formerly located at 2818 East Belgrade Street, Philadelphia.

The 6000 sq ft building in which the new branch is located will provide additional warehouse space as well as laboratory facilities, according to James Clifford, regional sales manager. The new installation is under the direction of William Moyer.

EADS CO. APPOINTED BY COMMERCIAL FILTERS CORP.

The Eads Co., Houston, Texas, has been appointed to handle CFC Honan-Crane and Delpark filtration equipment for Commercial Filters Corp. Product line includes filters to provide microclarity for industrial oils and other liquids. Shaw Engineering of Houston will continue to handle CFC Fulflo filters.

WHEELABRATOR ACQUIRES LORD CHEMICAL CORP.

Wheelabrator Corp., Mishawaka, Indiana, manufacturer of blast cleaning equipment, steel abrasives, and dust and fume control equipment, has acquired approximately 80 per cent of the controlling stock of Lord Chemical Corporation, York, Pa.

As a majority-owned subsidiary of Wheelabrator, Lord Chemical will continue to operate in York, manufacturing its line of vibratory and barrel type finishing equipment, including compounds and media for cleaning, deburring, and precision finishing.

Wheelabrator entered the precision finishing field in July, 1958, when it organized its Techline Division, Vicksburg, Michigan.

Officers of the Lord Chemical Corp. include: James F. Connaughton, chairman of the board; H. R. Stitely, president; J. A. Schmidt, vice president-treasurer; H. E. Smith, secretary; and J. M. Wolf, controller.

WALTER MEYER AWARDED PATENT

Effective December 1, 1959, the U. S. Patent Office has issued patent No. 2,915,444, to Dr. Walter R. Meyer, president of Enthone Inc., New Haven, Conn., for an electrolytic alkaline descaling and derusting process.

Based on a series of alkaline iron complexing compounds, the process is at present marketed under the trade name "Alka-Deox".

This is the thirteenth patent issued to Dr. Meyer, who, as president of Enthone since 1942, has built the company from a small business to a multi-million dollar enterprise. An honor graduate of Yale University, Dr. Meyer is a recipient of the Founders' Gold Medal and Award of Merit of the American Electroplaters' Society. He is the author of many fundamental articles and is a contributor to the ASM Metals Handbook, Modern Electroplating and Plating and Finishing Guidebook.

KNOWLEDGE OF INESTIMABLE VALUE IN THESE AES RESEARCH PROJECT REPORTS CURRENTLY AVAILABLE

Cleaning and Preparation of Metals for Electroplating, IV, V, VI & VII—By H. B. Linford & E. B. Saubestre — *Serial 26, Project 12, $3.50*

Methods for Testing Thickness of Electrodeposits, II & III—By H. J. Read & F. R. Lorenz — *Serial 27, Project 7, $1.35*

Porosity of Electrodeposited Metals—By N. Thon, D. G. Kelemen, L. Yang, S. Yang, D. Dean — *Serial 28, Project 6, 85 Cents*

The Analysis of Electroplating Solutions for Major Constituents—By E. J. Serfass & M. H. Perry — *Serial 29, Project 2, 90 Cents*

Effect of Basis Metal Condition on Plating, I & II By A. E. R. Westman & A. F. Mohrnheim — *Serial 30, Project 14, $1.10*

Effect of Surface Finishing on Nonferrous Base Metals on Protective Value of Plated Coatings—By G. J. Kahan, W. W. Macchia, J. M. Fairbank — *Serial 31, Project 4, 45 Cents*

How the Small Electroplater Can Treat Cyanide Plating Waste Solutions with Hypochlorites—By Bernett F. Dodge and Walter Zabban, Yale University, New Haven, Connecticut — *Serial 33, Project 10, 50 Cents*

Effects of Impurities and Purification of Electroplating Solutions, IX, X & XI—By Dr. D. T. Ewing, Dr. A. J. Smith & Dr. W. O. Dow — *Serial 34, Project 5, 50 Cents*

Cleanability and Oil Spreading Rates—By H. B. Linford & P. E. Grubb — *Serial 35, Project 12, 50 Cents*

The Nature, Cause and Effect of the Porosity in Electrodeposits, I & II—By Fielding Ogburn, Asaf Benderly and Margaret Hilkert — *Serial 36, Project 13, $1.00*

Microthrowing Power, A Literature Search—By Esther B. Leffler and Henry Leidheiser Jr. — *Serial 37, Project 17, 75 Cents*

The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating IV—By M. H. Jones, Chih-Yeu Lu and J. Zajdowski — *Serial 38, Project 14, $1.25*

Mechanical Finishing of Metal Surfaces—Bibliography—By C. E. Kennedy, J. E. Fritts, R. S. Modjeska, L. E. Weeg & R. V. Twyning — *Serial 39, Project 18, 50 Cents*

The Nature, Cause and Effect of the Porosity in Electrodeposits, III, IV & V—By Fielding Ogburn, D. W. Ernst & W. H. Roberts — *Serial 40, Project 13, 50 Cents*

An Introduction to Fundamental Research on the Mechanism of the Electrodeposition of Metals—By B. E. Conway and J. O'M. Bockris — *Serial 41, Project 16, $1.00*

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Chemicals

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NICKEL SULFATE, 100 lb	36.00
POTASSIUM CYANIDE, 100 lb drum N. Y.	45.50
ROCHELLE SALTS, 100 lb	53.00
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SODIUM CYANIDE, domestic, f o b N. Y., 200 lb drums	23.80
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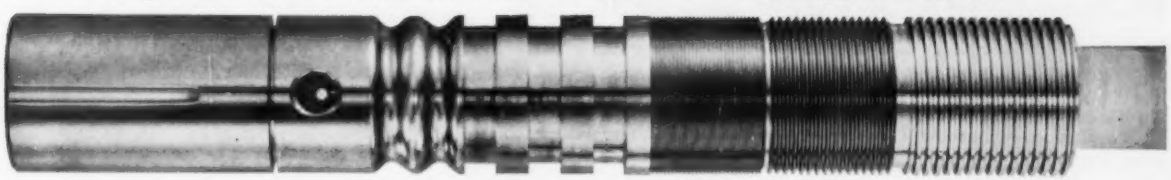

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INDUSTRY NEWS BRIEFS

LEA-RONAL HONORED BY PATENT OFFICE

Lea-Ronal, Inc., of Jamaica, New York has been selected by the Commissioner of Patents to be the organization representing the electroplating industry in the Chemical and Synthetics Division exhibit to be held from February 15 to March 11 in the main entrance hall of the Department of Commerce Building, Washington, D. C. The Department has also invited 15 companies representing other branches of this Division to exhibit. Following this display, the exhibits will be moved to the Franklin Institute in Philadelphia and will be shown there from March 14 to April 11.

The purpose of the Patent Office in promoting these exhibits is to draw national attention to the research and development continually carried on by American industry as exemplified by the selected companies, and which are reflected in the activity of the Patent Office.

From its inception 10 years ago, Lea-Ronal has been engaged extensively in research and development of processes for the metal finishing industry.

DU PONT GRANTS AID SCIENTIFIC RESEARCH AND TEACHING

Grants totaling more than $1,300,000 have been awarded to 143 universities and colleges in the Du Pont Company's annual program of aid to education.

The program is for fundamental research by universities, for strengthening the teaching of science and related subjects, and for facilities for education or research in science and engineering.

Grants totaling $580,000 were awarded for the 1960-61 academic year to more than 100 colleges and universities to support the teaching of science and mathematics as well as other liberal arts subjects; for education and research in biochemistry in medical schools; and for postgraduate teaching awards and scholarships.

Grants for fundamental research in 1960–61 totaled $475,000 for 37 universities. These are for unrestricted research in the physical sciences, including chemistry, chemical engineering, physics, mechanical engineering, and metallurgy.

CORRECTION

GOLDEN JUBILEE EDITION
TECHNICAL PROCEEDINGS
(1959 EDITION)
AMERICAN ELECTROPLATERS' SOCIETY INC.

An error in text sequence appears in the paper "The Effect of Shot-Peening and of Grinding on the Fatigue Strength of Chromium Plated High Strength Steel" by C. Williams and R. A. F. Hammond as published in the Golden Jubilee Edition of the AES's book TECHNICAL PROCEEDINGS (1959 Edition).

Line 13 of the first column on page 202 should be followed directly by line 17 of the second column. All of the text between, commencing with "This value of 1_e is somewhat lower . . ." and ending with Conclusion 8, correctly should immediately precede the ACKNOWLEDGMENT on page 204.

It will be appreciated if you will either correct your own copy or ask for a sheet embodying the correction which you can insert in your copy of TECHNICAL PROCEEDINGS.

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PATENT ABSTRACTS

DR. D. GARDNER FOULKE
SEL-REX CORPORATION
Nutley, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,850,415, 9/2/58—Phosphating Bath—G. Otto and F. Heller, assignors to Amchem Products, Inc., Ambler, Pa.

A metal coating bath consisting essentially of an aqueous acid phosphate bath capable of producing a crystalline phosphate coating on the surface of a metal is described as improved with the addition (emulsified therein) of 0.1 to 5 per cent (W/V) of a saturated straight chain fatty acid having at least 12 carbon atoms.

6 claims.

No. 2,870,070, 1/20/59—Electrodeposition of Tin—R. Higgs and C. Owen, assignors to U. S. Steel Corp., New Jersey.

The electrolyte is described as containing 30 to 80 g/l of sulfamic acid 15 to 50 g/l of stannous ions and 0.2 to 10 g/l of an addition agent selected from the group consisting of diethyl, trimethyl, tetramethyl dihydroquinoline, dihydroxydiphenyl sulfane, bisparahydroxyphenyl propane and dihydroxybenzophenone.

2 claims.

No. 2,872,342, 2/3/59—Catalytic Nickel Plating—H. Nack, assignor to The Commonwealth Engineering Co., Dayton, Ohio.

Pass hydrogen gas, which has been caused to flow over pure nickel, over a metal substrate after which contact said substrate with nickel carbonyl.

2 claims.

No. 2,882,134, 4/14/59—Aluminum Etching—S. Spring and R. Elliot, assignors to Pennsalt Chemicals Corporation, Philadelphia, Pa.

An aluminum etching solution is described as 1 to 15 per cent of an etching alkali and 1 to 10 per cent of tartaric acid and 0.2 to 1 per cent of an alkali salt of ethylene diamine tetra-acetic acid based upon the alkali etchant.

See also No. 2,882,135 claiming the use of calcium, strontium and barium ions in an aluminum etch in the amount of 3 to 140 per cent of the scale inhibitor with 12 claims.

7 claims.

No. 2,887,418, 5/19/59—Chrome Pickling Magnesium—L. Whilby, assignor to The Dow Chemical Co., Midland, Mich.

An improvement on the chrome-pickle (HNO_3 and alkali metal chromate) is described as the addition of 0.01–0.5 per cent of a surfactant (alkylarylsulfonates, halo-substituted alkane sulfonates, etc.)

7 claims.

No. 2,887,419, 5/19/59—Coating—C. Baer, *et al*, assignors to National Research Corp., Cambridge, Mass.

Claim 1 reads: "The process of producing a shiny, adherent, corrosion-resistant aluminum coating on black iron which com-

prises the steps of exposing black iron to a source of aluminum vapors in a vacuum chamber maintained at a pressure on the order of 10 microns Hg abs. and less to deposit on the black iron a film of aluminum having a thickness between about 1 to 30 microinches, and thereafter heating the aluminum-coated black iron in an oxidizing atmosphere at a temperature about 350F and below about 700F, said heating being continued for at least a minimum time ranging between a few seconds at 700F to a few minutes at 350F and being sufficiently long to form an iron aluminate bond between the black iron and the thin aluminum coating."

9 claims, 1 figure.

No. 2,887,442, 5/19/59—Plating Copper—H. Van Oosterhaut, assignor to N. V. Metallic Industry, Loosdrecht, Netherlands.

To an acidic copper solution add at least 1 mol/l of a diamine (bp 100–150C) and a saturated monoamino carboxylic acid sufficient to complex the copper.

9 claims.

No. 2,887,447, 5/19/59—Electroplating Apparatus—Leslie Lancy, Ellwood City, Pa.

An apparatus for electrically treating and advancing work articles in series progression between upper and lower electrodes is described.

10 claims, figure.

No. 2,887,766, 5/26/59—Composite Metal Article—R. Fike and A. Pilous, assignors to Borg-Warner Corp., Chicago, Ill.

A composite metal structure comprising aluminum (or alloy) a plating of nickel, a copper lead alloy member, a layer of tin disposed between the nickel and the copper alloy and a layer of babbit on the copper alloy is claimed.

10 claims, figure.

No. 2,888,335, 5/26/59—Process of Chemical Etching—D. Atkins and R. Edds, assignors to Turco Products, Inc., Los Angles, Calif.

Coating or masking of surfaces of objects to protect against etching is described.

3 claims, 3 figures.

No. 2,888,336, 5/26/59—Printed Circuit—E. Padgett, Morristown, N. J.

A color coded printed circuit is described.

2 claims, figure.

No. 2,888,375, 5/26/59—Gas Plating—F. Drummond, assignor to The Commonwealth Engineering Co., Dayton, Ohio.

The gas plating of blown glass fibers is claimed.

1 claim, figure.

No. 2,888,387, 5/26/59—Electroplating—A. Wasserman, assignor to Tiarco Corp., Newark, N. J.

To plate an aluminum article make anodic in a HCl solution (0.2–1.2N) for 3 amp-min/sq in., make cathodic in HCl (0.5–1.2N) for 3 amp-min/sq. in., rinse and plate with chromium.

8 claims.

No. 2,888,388, 5/26/59—Sealing of Anodized Aluminum—F. Stitler, assignor to Sandoz, Inc., New York, N. Y.

Claim 1 reads: "In the sealing of dyed anodically oxidized aluminum by means of a hydrolyzable metallic salt in an aqueous bath, the improvement which consists of carrying out the sealing operation in the presence in the bath of at least 0.1 per cent by weight of, as sole sulfonate additament, a compound containing the lignosulfonate radical, whereby a smut-free product which requires no mechanical after treatment is obtained."

10 claims.

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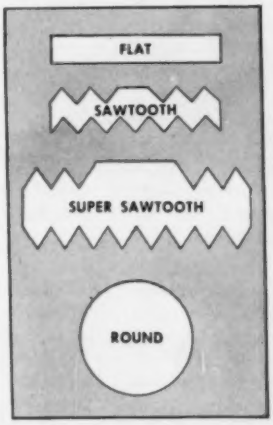

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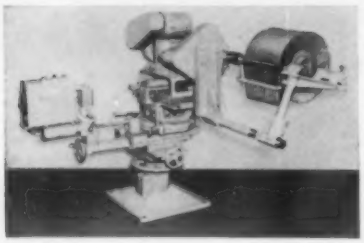

E—201. Buffing Machine—A new Acme oscillating arm-type machine claimed to provide a method for automatically buffing or polishing a wide variety of parts which have obstructions that prevent complete rotation is now available from Acme Manufacturing Co. The machine is adapted to the buffing of parts such as coffee pots with spouts or ratchet-type wrench heads with handles that prevent complete rotation of the part in contact with the buffing wheel.

Basically, the machine consists of an Acme E-10 semi-automatic machine equipped with an air cylinder advance and an oscillating arm fixture. Parts can be mounted on an arbor with a locator and square drive. Then the arbor and part assembly are positioned in the oscillating-arm unit by an air-powered tailstock. Other special types of part chucking arrangements can be provided to suit the part requirements.

E—202. Alkaline Deruster—The Endox process, a patented, alkaline method for derusting and descaling of steel and activating it for plating, has been announced by Enthone, Inc. The process is said to remove rust, scale, carbon smut, oxides and light soil from iron and steel alloys by electrolytic treatment in an alkaline solution at room temperature.

Acid pickling with its accompanying attack of the work and surrounding equipment and its production of carbon smut on the steel surface is claimed to be eliminated. Acid dips in plating lines are also eliminated due to the deoxidizing and activating ability of the Endox process. Complete preparation of steel for plating in one simple step is said to be possible with this alkaline process.

Either of two new products, Endox 209 or Endox 214, can be used to make up the processing solution. Both are completely prepared, powdered materials which need only be dissolved in cold water at concentrations of from 1 to 3 lb/gal to make up the bath. No other salts are required.

E—203. Zinc Plating Brighteners—Two new brightening agents for zinc plating have been developed by Allied Research Products, Inc.

Named Isobrite No. 354 and Isobrite No. 355, both are supplied in liquid form. They are stable, providing effective brightening even after weekend shutdowns. Liquid form eliminates mixing, and simplifies control.

E—204. Oxide Film Remover—Oxide scale and heat discoloration are claimed to be removed from aluminum by a one step method with Ox-Off No. 536 developed by Chemclean Products Corp.

E—205. Nickel Plating Process—Greater protection against severe corrosive environments is coupled with distinct production advantages in a new process of plating two layers of nickel under a chrome finish, developed by the Udylite Corp. The process is used on steel and on copper-plated zinc-base die castings.

Registered under the name "Bi/Nickel," the new Udylite process is said to solve the problem of adhesion between nickel layers.

Using any of several combinations of semi-bright and fully bright plating processes, the Bi/Nickel system first coats the basis metal with a heavy layer of semi-bright nickel. A layer of bright nickel is then applied, and finally, chromium. Adhesion of the bright nickel layer to the semi-bright has been described as "virtually free of problems."

Use of particular combinations of semi-bright and bright nickel, and varying thicknesses of the coatings, company representatives explain, is determined by the specific requirements of individual applications.

E—206. Plating Cylinder—Hanson-Van Winkle-Munning Co. announces the availability of a plexiglas, belt driven plating cylinder. The unit's motor drive is mounted directly on the pulley shaft and hanger assembly.

The newly designed cylinder effects two important savings, according to the manufacturer. Because the cylinder rotates constantly there is less dragout from tank to tank, which also means more thorough rinsing. The second saving is realized in applications where there are a large number of tanks and a relatively small number of cylinders. Because each cylinder has its own motor drive, the need for tank motors is eliminated and therefore the total number of motor drives is reduced.

Any standard H-VW-M Mercil belt drive cylinder can be converted to this type unit by simply adding the motor drive and converting the angle iron hanger tie rod.

E—207. Bleeding Eliminator—Heatbath Corp. has introduced No Bleed, a liquid product used for removing entrapped salts from electroplated powdered metal parts. It is said to eliminate the bleeding or staining condition usually associated with plated powdered metal parts.

The parts, plated by established methods, can be post treated followed by hot water rinsing and drying prior to immersion in No Bleed.

The new solutions are operated at 250–275F; the parts to be treated are immersed for 2–5 min or until all visible gassing action ceases. No Bleed will not remove stains or bleeding salt deposits once they appear; it must be used on freshly plated parts.

E—208. Centrifugal Pump—A new type of centrifugal pump specifically designed for transferring corrosive liquids and solvents without leakage is being offered by Sethco Manufacturing Corp. Called El-10, it features a pump which is inside the motor housing, magnetically driven by the motor.

Stuffing boxes, mechanical seals, shaft wear, coupling and alignment problems are eliminated, resulting in leakproof and maintenance free operation.

Maximum flow with water is 20 gal/min. Maximum head developed is 25 ft. Liquids can be handled up to specific gravities of 1.5. Maximum working pressure is 150 psi.

Mounted in vertical position on 3 stainless steel legs, the pump is furnished with a stainless steel carrying bracket with rubber handle for easy portability.

Metals & Controls' Eastern Regional Manager C. J. Grube discusses with Gemex Master Electroplater Hy Libovitz one of Gemex's installations of a General Plate expanded platinum-clad tantalum anode (shown, left, magnified size).

GENERAL PLATE

Expanded Platinum-Clad Tantalum Anodes

Reduce Platinum Costs, Speed Plating Time and Conserve Plating Solution for The Gemex Corporation

There are good reasons why The Gemex Corporation, a recognized leader for quality, workmanship and styling of Gemex watchbands, uses General Plate platinum-clad anodes.

Here's how Mr. Hy Libovitz, Superintendent, Finishing and Plating Department, Master Electroplater with 42 years of association with Gemex explains it: —

"General Plate platinum-clad tantalum expanded anode offers the most revolutionary advancement in modern day electroplating medium. It gives us such outstanding results as faster plating time, complete circulation of plating solution, and it conserves our rhodium plating solutions."

Platinum clad to one side of tantalum sheet, and then expanded to a mesh can substantially reduce your cost over solid platinum anodes. The greater distribution of anode surface obtained by expanded clad metal allows more uniform plating. The tantalum layer isn't affected by chemicals in the plating bath nor does it contaminate the bath.

Metals & Controls also supplies rhodium sulphate and rhodium phosphate solutions in unbreakable, transparent containers marked with graduations, and refines contaminated solutions.

Why not *reduce your cost* of rhodium electroplating by using General Plate expanded platinum-clad tantalum anodes and rhodium plating solutions? Write today for more information, or send us your specifications and we will gladly quote on your requirements.

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SCIENCE

E—209. Goblet Finishing Buff—A new goblet finishing buff for metal finishing has been announced by The Schlegel Manufacturing Co. Made of springy, dense wool fibers mounted on a solid 4 in. minimum to 8 in. maximum diameter hemispheric core, the new unit is known as the Schlegel Ray Buf Style 154.

E—210. Electronic Thickness Gage—Coatings of any type and thickness it is claimed can now be measured quickly and accurately with a new electric micro-gage and comparator called the Elcotector, now available for the first time in the U.S., from the Supply Division, Ferro Corp. In addition to measuring metallic and non-

metallic coatings on any dissimilar bases, the unit will also compare the hardness and grades of metals and other materials.

The unit operates on the eddy-current principle by making use of the fact that the electrical characteristics of a coil are influenced in proportion to the conductivity of the materials being measured. The Elcotector is manufactured in England.

E—211. Nickel Anode—Hanson-Van Winkle-Munning Co. announces the availability of a new-shape nickel anode featuring less proportionate scrap loss per anode and longer runs between replacement periods. Longer running time results in a savings in labor costs and fewer anode bag replacements.

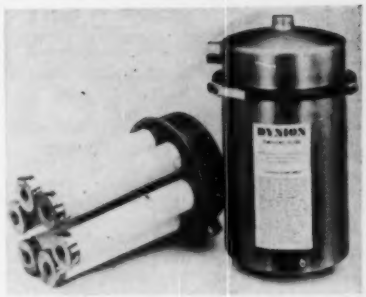
The new shape anode is called Econ-O-Shape and will be marketed in a new type anode shipping container made of heavy pasteboard which holds the anodes firmly in place during shipment.

E—212. Ultrasonic Cleaning Unit—National Ultrasonic Corp. announces a new ultrasonic unit. This cleaner, Model 140, features a 7-gal heavy gage polished stainless steel tank 14¾ in. long, 11¾ in. wide and 10 in. deep. The tank has deep drawn rounded corners to facilitate the rinsing out of contaminants removed by ultrasonic energy.

The 115-v ac single-phase 60-cycle generator, designed for continuous operation, delivers an average power output of 250 w and produces peaks of 1000 w. Features include one-tube oscillator, front panel switching which permits a choice of either of two transducers, forced air cooling and 3-wire ground protection.

E—213. Water Filter—The Dynion water purifying filter which is said to eliminate roughness, cloudiness in quality decorative plating is now available through the Scharf Manufacturing Co. Capable of removing suspended micro-size matter from ordinary tap water, the filter delivers pure, polished water important in obtaining clean, unblemished work.

Hollow filter, high porosity candles im-



pregnated with ional silver form the basic part of the filter. These ceramic tubes made of diatomaceous earth create instant, non-toxic purifying action. The micro-fine porosity of the candle walls traps and filters out all micro-size life, suspended solids and metal without changing the chemical content of the water.

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ARTICLE REFERENCES

By
WILLIAM TUCKER
Eastman Kodak
Rochester, N. Y.

Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

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c. *B. MECHANISMS BY WHICH NON-FERROUS METALS CORRODE IN THE ATMOSPHERE.*
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31. ORGANICS

a. *CONVEYORIZED FINISHING OF OFFICE FURNITURE.*
Ed Fritz.
Products Finishing, September 1959, pp. 28–38.

b. *TRAVELING BOOTH FOR SPRAYING RAILROAD CARS.*
Zeke Cook.
Metal Finishing, September 1959, *57*, No. 9, pp. 68–69.

c. *MULTICOLOR COATINGS FOR CORROSION PROTECTION.*
Norman I. Gaynes.
Metal Finishing, *57*, No. 9, September 1959, pp. 73–76.

d. *WHEN TO CONSIDER AUTOMATIC SPRAY EQUIPMENT.*
Warren Beach.
Metal Finishing, October 1959, *57*, No. 10, pp. 69–71, 76.

e. *FLUIDIZED BED COATING—SOLUTION TO DIFFICULT FINISHING OPERATION.*
Walter R. Pascoe.
Metal Finishing, October 1959, *57*, No. 10, pp. 74–75, 80.

f. *EPOXY RESINS IN ANTI-CORROSIVE APPLICATIONS.*
P. A. Dunn.
Corrosion Technology, August 1959, *6*, No. 8, pp. 223–225.

g. *TAKE ANOTHER LOOK AT AIRLESS SPRAY.*
Don P. Volino.
Products Finishing, November 1959, pp. 54–58.

h. *INFRA RED BAKING OF ORGANIC FINISHES.*
G. J. Marotta.
Metal Finishing, December 1959, *57*, No. 12, pp. 69–73.

i. *APPLICATION OF EPOXY RESIN-BASED COATINGS IN CORROSIVE ENVIRONMENTS.*
H. Brull.
Corrosion Technology, October 1959, *6*, No. 10, pp. 303–306, 312.

j. *THOSE VERSATILE VINYLS.*
Gerard H. Poll Jr.
Products Finishing, December 1959, pp. 36–51.

32. TESTING

TESTING PLATING DURABILITY—THE COPPER-ACCELERATED ACETIC ACID TEST.
George L. Sukes.
Metal Finishing, December 1959, *57*, No. 12, pp. 59–65.

33. PRODUCTION

REPLATING BATTERED, BUMPERS.
Gerard H. Poll Jr.
Products Finishing, September 1959 pp. 40–51.

34. RESEARCH AND DEVELOPMENT

METHODS FOR INVESTIGATING THE CHARACTERISTICS OF REACTIVE COATINGS.
Max Kronstein.
Corrosion, October 1959, *15*, No. 10, pp. 18–22.

35. SURFACTANTS

SCIENCE FOR THE COATINGS TECHNOLOGIST. PART XIV. ADDITIVES: SURFACTANTS.
E. S. Beck.
Metal Finishing, November 1959, *57*, No. 11, pp. 76–79.

Corrosion
National Association of Corrosion Engineers
1061 M & M Bldg
No 1 Main St.
Houston 2, Texas
Corrosion Technology
Leonard Hill Technical Group
Stratford House
9 Eden St.
London, N.W. 1
England
Electroplating
547 Kalbadevi Road
Bombay 2, India
Electroplating and Metal Finishing
15 Udney Park Rd.
Teddington, Middlesex
England
Grinding and Finishing
Hitchcock Publications
Wheaton, Illinois
The Iron Age
Chestnut and 56th Streets
Philadelphia 39, Pa.
J. Electrochemical Society
1860 Broadway
New York 23, N. Y.
J. Institute of Metals
17 Belgrave Square
London, S.W. 1, England
Metal Finishing
381 Broadway
Westwood, N. J.
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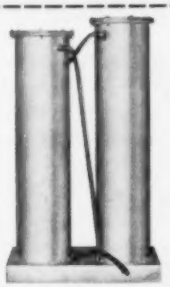

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Separation of rare earth metals

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TRADE LITERATURE

L—201. Plating of Printed Circuits—Solutions to the problem of the failure in service of plated printed circuits, are offered in a 4-page article co-authored by E. C. Rinker, vice president and technical director, Precious Metals Division, Sel-Rex Corp.

Starting with the specific application and intended service of the printed circuit, the article recommends ways and means to improve in-service reliability through latest developments in printed circuits plating technology. The precious metals, and various base metals, are covered in detail with their advantages and disadadvantages for specific applications.

A table gives recommended thicknesses of electroplate of various base and precious metals, predicated by the application of the printed circuit.

Reprints of the article called Improved Baths Solve Lifting of Plated Circuit Foils, may be had free of charge.

L—202. Acidic Finishing Solution—An acidic solution used to produce brilliant finishes on solid nickel or electrodeposited nickel and some nickel alloys is described in Technical Data Sheet No. 42, a two-page usage and instruction sheet prepared by MacDermid Incorporated. Called Metex Electropolish BN, the solution is used full strength as received and operated at 115F. The solution has long life and can be controlled by specific gravity.

L—203. Vacuum Pumps—Bulletin No. 8-20, published by Consolidated Vacuum Corp., details the application of vacuum pumps to numerous vacuum processes, including metal vapor deposition. The pumps cover a wide range of speeds and throughputs.

L—204. Demineralizer—A new packaged demineralizer designed for quick installation has been developed by Cochrane Corp. On-site erection consists of setting the unit in place and connecting to air and raw water supply, treated water outlet, and open drain.

L—205. Booth Coating—A technical brochure is now available from Spraylat Corp. on "Booth Strip", a new water-based non-inflammable, non-toxic booth coating which, applied by any standard spray gun, covers an entire spraybooth in minutes, protecting surfaces, and peeling off for quick clean-up.

L—206. Processing Equipment—Pennsalt Chemicals Corp. has published a new illustrated brochure on its metal processing equipment. The 15-page booklet describes the range of machines, materials and services offered for every type of metal processing requirement. The brochure describes Pennsalt's machines, tailored for specific jobs, and the company's lines of metal cleaning, coating and lubricating compounds. Included are metal cleaners, aluminum cleaners, etchants, and brighteners, descaling and pickling compounds, phosphatizing agents, pre-lubricant coatings, drawing compounds, deep drawing lubricants, paint strippers, strippable vinyl coatings and quality processing chemicals.

L—207. Barrel Finishing—"The Carbotrol 7 System of Barrel Finishing . . . and what it means to you" is treated in The Carborundum Co.'s brochure, The Abrasives' Workshop.

Tumbling media and compounds are described and a page of practical "do's" and "don't's" for operators is provided.

L—208. Abrasives—Performance and statistical data compiled in abrasive research and experimentation is revealed for the first time in a new illustrated Handbook of Blast Cleaning Abrasive Performance offered by Wheelabrator Corp.

Topics discussed include: how performance controls economy in blast cleaning abrasives, how abrasive breakdown characteristics affect finishes and cleaning costs, how abrasive hardness affects cleaning speed, how abrasive size affects finish quality, how to control the finish achieved by airless blast cleaning.

L—209. Finishing Process—Integrated, trichlorethylene-based degreasing, phosphatizing and painting systems by G. S. Blakeslee & Co. for its new Tri-Finish process are introduced, along with an explanation of the new process and the costs involved, in a new 6-page, illustrated catalog.

The Process is flexible and equipment for it is available from Blakeslee in three basic systems (either dip or spray type), which can be incorporated into present finishing operations, large or small. The three systems are: (1) Vapor degreasing and nonflammable tri-thinned painting in a single unit; (2) Vapor degreasing and tri-phosphatizing combined in two units, and; (3) Vapor degreasing, tri-phosphatizing and painting in a continuous compact system.

L—210. Abrasive Finishing—A new data sheet giving step-by-step procedures for the abrasive finishing of solid copper stampings, castings, extrusions and spinnings has been made available by The Lea Manufacturing Co. Data covers satin finishing and bright or high color finishing including recommendations on wheel heading, lubrication, surface speed and type of buff.

L—211. Valve—Monotrol, a new single control valve for zeolite softeners, ion exchange units and filters, is the subject of Bulletin WC-122 available from Graver Water Conditioning Co.

The bulletin discusses design, operation and construction details of the cast iron unit and the exclusive all-plastic unit for corrosive service. Among the features covered are pilot control, hydraulic pressure actuation and provision for no leakage and low pressure loss. Schematic drawings of flow are included.

L—212. Cleaning and Phosphating Compounds—An 8-page pamphlet available from Frederick Gumm Chemical Co. describes their Clepo-Phos 196 and 196-F powdered compounds for removal of light oil and the phosphating of steel surfaces in one operation prior to painting. The compounds in the order mentioned are used for still tank soaking or wash machine spraying. Parts are treated in a solution of compound and water, rinsed, passivated and dried. The entire cycle requires about five minutes.

The treatment is said to produce a thin, strong coating of iron phosphates bonded to the surface of the steel and sufficiently matte so that the paint or enamel interlocks with it.

L—213. Chemical Milling—Chemical Contour Corp. is offering their new facilities brochure.

The 12-page, illustrated, two-color booklet describes the process of chemical milling.

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MAJOR DEVELOPMENTS IN EVERY PHASE OF THE INDUSTRY COME FROM THE WORLD'S LARGEST PLATING SUPPLIER

Udylite steps up the production of new equipment and processes and continues its expanding program of research and new product development. Here are some of the New benefit-packed innovations that Udylite has ready for you NOW.

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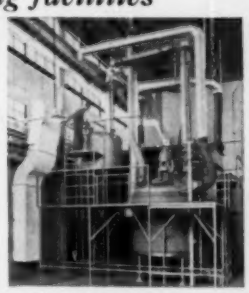
New Tank lining Brand new tank lining . . . for special applications . . . introducing a new recently perfected material of unusual properties . . . an EXCLUSIVE with Udylite.

New Filter series Improved . . . high area . . . low pressure filters . . . designed with economy of operation in mind for you . . . long range savings . . . low, low maintenance costs . . . greatly increased efficiency . . . full range of sizes and capacities.

New Processes due Another great forward step in the battle against corrosion . . . A NEW Udylite bright plate process . . . now under rigorous testing for introduction early in the spring . . . a product of the continuing research and development that gave you "The Incomparable 66" and Bi/NICKEL.

New Automatic Machine features Plating automation . . . equipment advances . . . including new skip mechanism . . . 1960 models of Cyclemaster . . . and the famous Udylite V.I.P., automated barrel plating machine . . . to fit economy budgets.

New manufacturing facilities $600,000.00 expansion program at Udylite, Detroit . . . installation permits quality controlled production of vital raw materials . . . guarantees source of supply . . . provides you with product of insured purity . . . at a reasonable price.



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The newest and the best in plating supplies, equipment and processes . . . products such as those shown here flow constantly from Udylite to industry. Watch for detailed announcements every month. If you'd like to learn more about any of the developments we've talked about right away, just get in touch with your Udylite man today or write to:

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world's largest plating supplier

L—214. Demineralizer—A four-page bulletin on a new line of standardized Uni-Pac packaged mixed bed demineralizers, designed specially for process water applications, is now available from Cochrane Corp. The new "M" series mixed bed design range up to 13,200 gal/hr.

L—215. Immersion Heat Exchangers and Steam Jets—A new 12-page illustrated bulletin on Karbate impervious graphite immersion heat exchangers and circulating steam jets for heating or cooling corrosive solutions in all types of tanks is available from National Carbon Co., Division of Union Carbide Corp.

Separate sections on plate, bayonet, and coil type immersion heat exchangers include general descriptive, installation, and operation information. Dimensioned sketches of each type give complete construction details, and tables present information on weights and effective surface areas.

L—216. Anodizing—What is the cost of anodizing aluminum? Can anodized parts be formed? How much heat can anodic films withstand? Does anodizing change the dimension of a part?

Answers to these and similar questions are found in a new booklet, "Questions and Answers about Anodizing," just published by Reynolds Metals Co.

L—217. Phosphate Coatings—A new 4-page bulletin has been made available by the Neilson Chemical Co. furnishing information on iron and zinc phosphate coating chemicals and processes for steel and aluminum surfaces, rust removers, conversion and oxide coatings for aluminum surfaces, rust removers, conversion and oxide coatings for aluminum surfaces, metal conditioners, metal etchants, spray booth compounds and paint strippers.

L—218. Plasma Jet Coating—A six-page illustrated brochure, on plasma jet coatings, metal and ceramic spraying, and other hard facing services for industry has been published by Cleveland Hard Facing, Inc.

Plasma jet coating is perhaps the most modern method of applying extremely high temperature and density overlays of corrosion and wear resistant metals and ceramics. This process employs an arc-gas device to heat gas to readily controllable temperatures in excess of 30,000 F.

With the use of plasma jet coatings, high purity metals and alloys can be applied. The metallic coatings are claimed to have maximum toughness in a wide range of temperatures. This process offers a wide choice of overlay metals and ceramics.

DAYTON BRANCH ANNUAL PROGRAM MARCH 5

The 14th Annual Educational Session and Dinner Dance of the Dayton Branch of the AES will be held on Saturday, March 5, 1960 at the Dayton Biltmore Hotel. Byron Bowman is general chairman, assisted by Larry Hadlock, co-chairman.

The Educational Session, under the direction of Robert Fisher, educational chairman, will begin promptly at 1 p.m. with Ralph D. Wysong, Supreme Society president, as honorary chairman. The speakers and their topics will be: Christopher Marzano, chief chemist, Amphenol Borg Electronics Corporation, "How to Plate Difficult Metals"; B. F. Lewis, technical director, Northwest Chemical Co., "Modern Metal Cleaning"; and Walter L. Pinner, manager plating service, McGean Chemical Co., "Preparation of Steel for Electroplating and Copper-Nickel-Chromium Coatings".

Jack V. Baker, hotel chairman, has announced that the doors to the ballroom will open at 6:15 with dinner scheduled for 6:45. The floor show, arranged by R. L. Ruleff, entertainment chairman, will start at 8:15 followed by dancing to the music of the Karl Taylor Orchestra.

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Accurate ph values in a few seconds right at the tank.

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Indicator AND control-colors on SAME strip. Control-colors in steps of 0.2 pH and 0.3 pH.

Plating ranges
(200 strips of a range per box)

No.	Acid:	No.	Alkaline:
6074	(6.0– 7.4 pH)	6680	(6.6– 8.0 pH)
4862	(*4.8–6.2 pH)	7387	(7.3– 8.7 pH)
3650	(*3.6–5.0 pH)	8610	(8.6–10.0 pH)
2439	(*2.4–3.9 pH)	10113	(10.1–11.3 pH)
1028	(1.0–2.8 pH)	11131	(11.0–13.1 pH)
0414	(0.4–1.4 pH)		

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Interrupts voltage to main line starter of rectifier feeding current to plating tank, where interruption is desired. Capable of handling rectifiers with capacity ranges from 500 to 10,000 amps.

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Interrupts current using auxiliary DC switch of proper capacity for interruption at bus-bars. Models available from 250 to 1500 amps DC:

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BOOKS

(*Continued from page 160*)

Electroless Nickel Plating STP 265, Catalytic Deposition of Nickel-Phosphorus Alloys by Chemical Reduction in Aqueous Solution, 74 pp. AES nonmembers, $2.50; AES members, $2.25.

This symposium gathers the known useful information about "electroless nickel" plating together under one cover. The need for this publication became evident a few years ago when a task group under ASTM Committee B-8 on Electrodeposited Metallic Coatings investigated the desirability of publishing a specification on "electroless nickel" plating. It was apparent that a survey of the current status and knowledge in this field would have to be made before serious work on specifications could be attempted.

The chapters by authorities on the subjects are History of the Electroless Plating Process by Abner Brenner; Chemical Reactions by Gregoire Gutzeit; Characteristics of Deposits by W. H. Metzer Jr.; Processing Procedures by Abraham Kreig; Advantages and Limitations by E. B. Saubestre; Applications by W. H. Safranek; Test Methods by Bennie Cohen; Patent Situation by Gregoire Gutzeit; Bibliography of References by C. F. Waite.

Paint Finishing in Industry, by A. A. B. Harvey, Process Research Engineer, Vauxhall Motors Ltd., Robert Draper Ltd., Middlesex, England, 1958. 516 pp. AES nonmembers, $12.00 (84s.); AES members, $9.60.

This book is a comprehensive description of the use of paints or more specifically, organic base finishes for industrial applications. As this is a British work, the subject is dealt with from the aspect of industry practices in Great Britain, although this should not be a deterrent to its being read with advantage by American readers.

The book is divided into three major parts: Part 1. Preparation for painting, under which the various methods of metal pickling and degreasing are discussed; also in this part are given various pretreatments of ferrous and non-ferrous metals in preparing these metals and alloys for painting. Proprietary as well as nonproprietary methods are described; some of the former are well known American products. In describing proprietary products, as worthy as they may be, the author faces the possibility of these descriptions becoming dated, because of the obsolescence of old products by the introduction of new.

A low priced ...vacuum type filter

Designed for use as an individual filter for multiple tanks in large shops. Ideal as a quality, low cost filter for small plating shops.

Information available through your local jobber

Capacity 500 G.P.H.
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Model PV-20-1000 G.P.H.
Price $850.00

A new simplified construction principle makes this low price possible.

The Sparkler Plater's-Pal will handle acid and cyanide solutions (except chromic acid and high chloride nickel).

The Sparkler PLATER'S-PAL will filter

Arsenic Cyanide
Brass Cyanide
Bronze Cyanide
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Neutralizers (Cyanide & Borax)
Tin Stannite
White Brass Alloy
Zinc Cyanide
Acid Copper Sulphate
Acid Zinc
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Copper Fluoborate
Lead Sodium Fluoborate
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Sparkler plating filters are used in some of the largest plating plants in the world.

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★ Only clean solution flows through the pump—no excessive pump wear.

★ Visual inspection of all parts including filter plates possible without dismantling filter.

★ All solution reclaimed.

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★ Cover locks and unlocks with one quick opening connection—no cover bolts, no complicated sealing devices.

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Sparkler International Ltd., with plants in Canada, Holland, Italy & Australia.

Filtration engineering and manufacturing exclusively for over 25 years.

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WHY GUESS ?

MEASURE PLATING THICKNESS

to a millionth of an inch

Your profits depend on meeting tight specifications, maintaining quality control and reducing rejects. Can you afford to guess at plating thickness when it is so easy to *measure and be sure*?

UNITRON'S PL-MEC PLATER'S MICROSCOPE substitutes facts for uncertainty. The plated deposit is observed through a Filar Micrometer Eyepiece and measurements are read directly from a micrometer drum. This compact microscope is easy to use, portable around the shop and has a built-in light source. It also doubles as a metallurgical microscope for examining grain structure etc. at magnifications of 25X-1500X. Permanent photographic records may be made using an accessory 35mm. camera attachment and provide valuable legal protection for subcontractors.

UNITRON'S PLATER'S MICROSCOPE will save its initial cost many times over. Prove this for yourself — as so many firms in the plating industry have done—by requesting a **FREE 10 DAY TRIAL** in your own plant. There is no cost and no obligation.

Above: Accessory camera attachment. Left: Observing the plated deposit.

$468 Model PL-MEC complete with all optics and standard accessories	As above with built-in camera attachment, but without 35mm. camera back: **$540**

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In discussing the preparation of cadmium plating for painting, the author fails to mention the well known method of using a chromate conversion coating after plating to assure good adhesion of subsequent paint coatings. He is evidently not certain of the value of chromate conversion coatings on zinc plating as he states "It must be stated that there is a divergence of opinion on the effect of unbleached (chromate) passivated films" (P. 62).

Part 2. Paint Application is subdivided into sections on spray painting with compressed air; airless and electrostatic spraying; other methods of paint application including dipping, flow coating, centrifugal and barrel coating, transfer techniques and various printing methods; spray booths and air conditioning; stoving (baking) convection and radiant equipment; intermediate and after treatments—sanding, polishing, repairing and stripping; paint services—distribution systems, containers and agitators, etc.

In Part 3. Finishing Specific Items, the author has taken four major phases, motor bodies, refrigerators, machinery and castings and factory wood finishing, and has described in detail the materials and procedures related to the finishing of these products.

Part 4. Miscellaneous covers paint shop troubles, inspection and service complaints; industrial finishes describing the various basic types such as spirit varnishes, japan, lacquers, synthetic resin base materials, including the recently developed plastisols, epoxys and acrylic ester resins; a section on paint testing in which are described quite adequately for a book of this type the many methods of determining the important physical characteristics of organic coatings that will decide the worth of the material for its intended use.

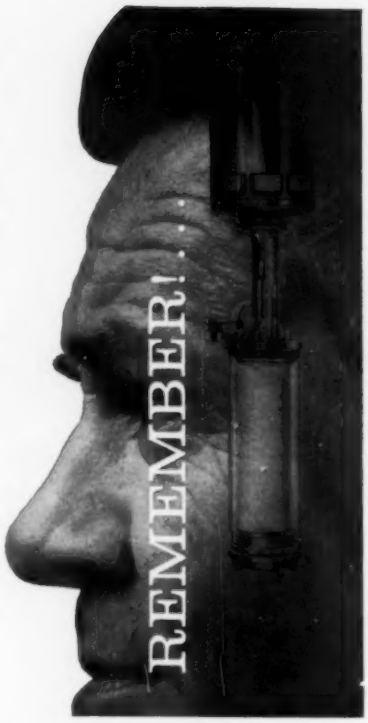
In the rear of the book are a complete listing of British and American Government paint specifications, tables of the properties of common solvents and conversion tables of measuring data used in the paint industry in metric, British (Imperial) and United States units.

Following a well organized index, the book concludes with 28 pages of advertisements of products of interest to the user of industrial organic finishes. The inclusion of advertisements in a book of this type is a practice very rarely done, if ever, in the United States.

The book is profusely illustrated with pictures taken in industrial locations, drawings, charts and tables of data. It should be noted that gallon quantities given in formulas refer to the Imperial gallon, which is 1.2 times larger than the United States gallon.

Notwithstanding the fact that this book is written around British industry practices and contains information about products not used in America, it contains a great deal of paint information useful to anyone concerned with industrial painting.

I. Wm. Marcovitch



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for faster, higher quality plating at lower cost

- Keeps surface clean regardless of solution level.
- No solution loss due to leaks. Most important in precious metal solutions.
- Entire filtering unit submerged in tank, cannot aerate solution.
- Requires only small space in tank . . . no equipment in aisles.
- Large, easy-to-clean filter area.
- Corrosion-resistant construction throughout.

Exclusive National Sales Representative

THE CHEMICAL CORPORATION

Makers of Luster-On® chromate conversion coatings for zinc, cadmium, copper, brass, aluminum —

The Chemical Corporation

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PERSONALS

KENNETH D. MILLER has been promoted to chief engineer, **AVERY B. SMITH** to supervisor of equipment operations, **JOEL R. FIELD** to technical representative—racks, and **GEORGE S. RUDOFF** to shop foreman of Enthone, Inc., subsidiary of American Smelting and Refining Co.

K. D. Miller

A. B. Smith

J. R. Field

G. S. Rudoff

Mr. Miller will direct the engineering, design and manufacturing facilities of the equipment department and, in addition, will serve as Enthone's plant engineer. He joined Enthone in August 1958 as design engineer and previously was a group engineer in the continuous equipment department of Hanson-Van Winkle-Munning Co. He is a member of the National Association of Power Engineers.

Mr. Smith will be in charge of production control and liaison with Enthone sales engineers and customers. He has been employed by Enthone since June 1957 in a supervisory capacity and is presently completing the requirements for a degree in industrial management at New Haven College.

Mr. Field will render technical service to customers on their plating rack requirements and will assist them with rack design. He has had 8 years of experience in directing rack design and manufacture for the rack division of Enthone's equipment department.

Mr. Rudoff will be responsible for direct supervision of the manufacturing facilities of the Enthone equipment shop. He previously held a similar position in the plastics division of the department.

●

HILTON M. SMITH JR. has been appointed sales representative for Belke Manufacturing Co. in Ohio, Southern Indiana, Kentucky and Tennessee.

Mr. Smith's experience in plating equipment and processing includes six years as sales representative for Hanson-Van Winkle-Munning Co. in the territory of Rhode Island, Massachusetts, New Hampshire and Maine, followed by the past two and one-half years in Wisconsin and Northeastern Illinois.

A native of New Jersey, Mr. Smith received his BS degree from New Jersey State Teachers College and has taken graduate work in chemistry, sales engineering and sales management at Rutgers University and the University of Wisconsin.

He is a member of the American Electroplaters' Society, having held office in the Boston Branch and is currently librarian of the Milwaukee Branch. He was instrumental in the formation and support of the Electroplaters School at the Racine Vocational School, Racine, Wisconsin in 1958–1959.

H. M. Smith Jr.

W. K. Sticksel

WILLIAM K. STICKSEL has been named sales engineer of Belke Manufacturing Co. His headquarters will be at the Belke plant in Chicago.

Mr. Sticksel is a 1945 graduate of Michigan State College, where he majored in chemical engineering. He had been active in sales and service to the plating industry with concerns like Udylite and the Diversey Corp. prior to joining Belke.

●

THOMAS N. URQUHART has received appointment as director of product evaluation for the Udylite Corp. In the newly created office, Mr. Urquhart will work with product engineers, cost accountants and marketing personnel to evaluate products and determine costs,

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FREE! SELF-SELLING 20-page catalog includes Schaffner's Buff 'n Polish Calculator, Speed Chart, Illustrations.

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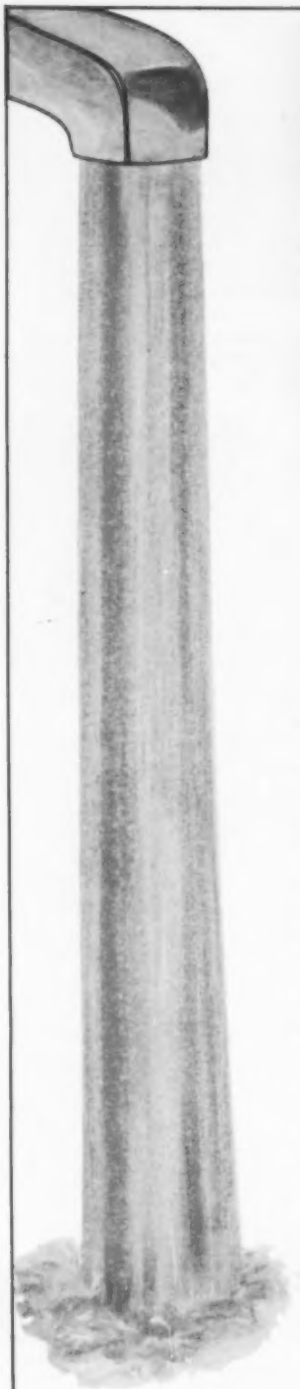

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T. N. Urquhart

R. P. Hayes

production procedures and new markets for Udylite's electroplating machines, processes and rectifiers.

Mr. Urquhart formerly was chief estimator for the company. He joined Udylite in 1950 and has worked as an estimator and supervisor in the quotation department.

A native of Schriever, La., Mr. Urquhart attended Western Michigan University and the University of Michigan, from which he received his degree. During World War II he served in the U.S. Navy.

RUTHERFORD P. HAYES has been promoted to chief estimator of the Udylite Corp. Mr. Hayes formerly was project estimator for the company.

A graduate of the University of Wisconsin (Class of '52), he worked as an industrial engineer for Alcoa before joining Udylite this year. During the Korean conflict Mr. Hayes served as a lieutenant in the Military Police.

•

JOHN V. HOUSTON JR. has become assistant manager of West Coast sales and development for Climax Molybdenum Co., a Division of American Metal Climax, Inc. He will operate from Climax' Los Angeles office.

GEORGE H. HALPIN

George H. Halpin, 69, vice chairman of the executive committee of Minnesota Mining and Manufacturing Company, St. Paul, and a past president of the American Supply and Machinery Manufacturers association as well as past president and member of the advisory board of American Hardware Manufacturers association, died recently after an illness of several months.

An executive during the early growth period, Mr. Halpin came to the firm in 1930 when 3M acquired Baeder Adamson, a Philadelphia abrasive firm for whom he was vice president, sales manager and director. In 1938 he was appointed a 3M company vice president and general sales manager, and a year later was elected to the board of directors. In 1949 he became executive vice president in charge of sales; in 1955 an executive vice president; and in 1956 was named vice chairman of the executive committee.

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Electroplating Engineering Handbook.... Edited by A. Kenneth Graham. 650 pages.	$10.00	$ 6.00
Principles of Electroplating and Electroforming..... by William Blum and George B. Hogaboom. 455 pages.	8.00	6.95
Modern Electroplating..... by Allen G. Gray. 563 pages.	9.50	8.25
Protective Coatings for Metals. 2nd edition by R. M. Burns and W. W. Bradley. 657 pages.	12.50	10.50
Analysis of Electroplating and Related Solutions—2nd edition, 1958..... by K. E. Langford. 423 pages.	9.00	7.20
Chromium Plating..... by P. Morisset, J. W. Oswald, C. R. Draper and R. Pinner. 611 pages.	11.00	9.50
Electrochemistry—Principles and Applications..... by E. C. Potter.	10.00	8.35
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Hot Organic Coatings. 225 pages..... by Raymond B. Seymour.	7.50	6.25
Handbook of Barrel Finishing..... by R. Enyedy.	8.25	7.00
Coated Abrasives—Modern Tool of Industry..... Coated Abrasives Manufacturers' Institute.	8.50	7.10
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Specifications and Tests for Electrodeposited Coatings, 1958..... Standards of ASTM Committee B-8.	2.25	2.00
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Aluminum Paint and Powder—3rd edition. by J. D. Edwards and R. I. Wray. 228 pages.	5.50	4.60
Electroanalytical Chemistry..... by J. J. Lingane. 683 pages.	13.05	12.55
Chromium—Two Volumes. Both..... Edited by Marvin J. Udy. 857 pages.	19.50	16.55
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BRANCH NEWS

Total AES Branches U. S., Canada, Australia, February 1, 1960—58.

BRITISH COLUMBIA
Electroplating Important to Skin Diving Equipment

A general meeting of the British Columbia Branch was held on Monday Nov. 23, 1959, at the Lougheed Hotel, Highway, Burnaby, B. C. There were 29 members and guests present. Cocktails and dinner preceded the business meeting. President **N. A. Shepherd** presided. The committee appointed to arrange the Christmas Party consisted of **W. Cragg,** chairman, **G. Amos, C. Schlossareck, H. Launder** and **R. Stotz. Geno Gamma,** a well known local skin diver, gave an extremely interesting and informative talk on his work. Mr. Gamma displayed skin diving equipment, and spoke of the importance of good electroplating in this field for the protection of the equipment against corrosion and made suggestions as to how electroplating may be employed in this field in the future.

D. A. Armstrong
Secretary

BRITISH COLUMBIA
Ladies Night a Success

British Columbia Branch held their December meeting at the Lougheed Hotel, Lougheed Highway, N. Burnaby, on Friday, Dec. 18. It was Ladies' Night, and members, with their wives and guests, came for a turkey supper, dancing, and entertainment.

The evening opened with cocktails at 7:45 p.m., with a Turkey Dinner commencing at 8:30 p.m.

The President and Mrs. **Shepherd** welcomed members and guests, and Secretary **Doug Armstrong** acted as M.C. for the evening.

Dancing followed an excellent meal, and throughout the evening there were various prizes, lucky spot waltzes, party games, etc.

The project was planned by a committee consisting of Bill Craig, chairman; **Claus Schlossareck, Henry Lauder** and **Bob Stotz,** who worked with Librarian **Gerry Amos** and Secretary Doug Armstrong, to make this a most successful and enjoyable evening.

Doug Armstrong
Branch Secretary

CHICAGO
Clough Talks on Vacuum Coatings

The Chicago Branch held its regular meeting on Friday, Dec. 4, 1959. **Charles Geldzahler** requested that members who plan to attend the convention in Los Angeles, submit their names to **Paul Glab** so that a group arrangement as to transportation, housing, etc., can be formulated. **Byron Ellis** introduced the speaker of the evening, **Phillip J. Clough,** National Research Corporation who spoke on "Vacuum Evaporated Coatings for Corrosion Resistance."

The conditions for metallizing are (1) the surface must be dry (2) stable and (3) clean. Metallizing consists in heating a metal in a vacuum, the metal evaporates into a vapor and condenses on a cool surface to form a bright coating. The parts are degreased and given a light sandblast prior to metallizing. Two popular metals used for vacuum metallizing are aluminum and cadmium. For decorative purposes in the toy and plastic jewelry fields, aluminum coatings in the order of 2 millionths of an inch are used. However, to have increased corrosion resistance thicker coatings such as 0.0002 mil or greater must be applied. Vacuum metallizing coatings of aluminum can be applied on steel, high tensile steel, steel stampings, stainless steel, cast iron, magnesium and aluminum diecastings. Aluminum coatings on steel are ductile at 0.001 mil thick can be anodized and dyed and serves as a very good base for lacquering and enamelling. This type of coating can also be deposited on parts that are usually difficult to electroplate and give a uniform finish which might include bolts, etc., and samples which he showed to the audience. A specific application of using metallized coatings of cadmium is on landing gears for the aircraft industry. There are three advantages using this process (1) no hydrogen embrittlement (2) there is definite control of thickness of deposit and uniformity (3) because the base metal is kept cold during the process no brittle diffusion layers of cadmium with the steel is formed. Aluminum coating can be deposited on steel at a price conquerable to chrome on steel. He also told of 96 hours corrosion tests and how the coating will be accepted by the air force. Slides were shown to illustrate the talk and after a question and answer period, Mr. Clough was given a vote of thanks for his interesting and informative talk.

Christopher Marzano
Publicity Chairman

CINCINNATI
Tri-State Plans Heard During Ladies' Night

The annual Ladies Night Meeting was held on Dec. 15, with 71 members, guests and their wives present. After dinner, President **Stephenson** introduced the officers of the Branch to the group and presented the Past Presidents' Pin to **Lester Helmich. Lee Howald** briefly discussed the plans for the Tri-State meeting which will be held in Cincinnati on April 23, 1960. **Ginny Stephenson,** Ladies Committee Chairman for the Tri-State meeting, asked for volunteers to act as hostesses in the Hospitality Room.

The speaker of the evening, Evans Schmeling, discussed the Eskimos in Greenland. Mr. Schmeling, who was second in command of a Geological Survey Expedition, spent three years in Greenland. The speaker discussed the way of life of the Eskimos and also gave examples of ther language and their customs.

A series of bingo games followed, with the winners taking some very nice gifts away with them. The social hour was sponsored by *Products Finishing* with **Ez Blount** and **Gerry Poll** as hosts.

David L. Kaplan
Secretary

DALLAS-FORT WORTH
Nichols and Thomas Speak on AES Affairs

The December meeting of the Dallas-Forth Worth Branch was held at the Texas Hotel in Fort Worth in conjunction with the First National Aerospace Finishing Symposium. This Dec. 7 gathering witnessed some 50 plus members and guests enjoy some real Texas cooking and words of wisdom from two fine speakers.

The meeting was formally called to order by Branch President **Myron Browning.** Following the introduction of a very lovely guest, Miss Susan Bagby, "Miss Dallas of 1959", by Program Chairman **D. L. Don Allie,** a brief recap of the days Symposium—AES groups meetings was presented by President Browning. Other guests, introduced by Secretary **A. C. Fricke,** included Kansas City Branch President **C. Scott Sterrett,** Houston Branch President **Jasper Dee** and Denver Branch President **Robert D. Martin.**

Guest speaker and National Exec. Secretary **John P. Nichols** was introduced to the group as the first National

BRANCH SECRETARIES

Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.

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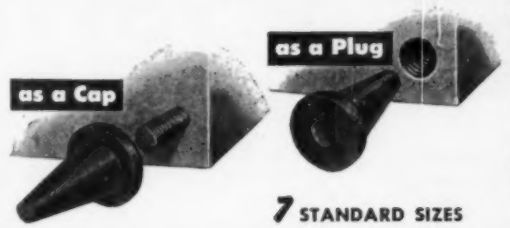

7 STANDARD SIZES

	A	B	C	D	E	F	G
TO PLUG HOLE SIZE	1/8-3/16	3/16-1/4	1/4-5/16	5/16-1/2	1/2-5/8	9/16-11/16	5/8-3/4
TO CAP STUD SIZE	3/32-5/32	5/32-3/16	3/16-1/4	1/4-5/16	5/16-3/8	3/8-7/16	5/16-1/2

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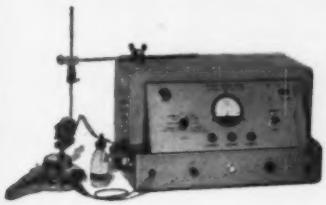

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AES Officer to speak in Fort Worth. Mr. Nichols presented some very fine ideas on group spirit, Branch togetherness and Society goals that AES is striving toward. The group gave Mr. Nichols a very cordial vote of thanks. The second speaker of the evening was **J. D. Thomas,** chairman of the AES National Research Committee, delivered a very informative summation of AES research projects, future thinking and plans, and some of the numerous benefits realized by AES Research.

After a resounding show of appreciation for both fine speaker, a motion for adjournment was passed.

T. E. Betz
Recording Secretary

HAMILTON
Waste Disposal Discussed by Voege

On Nov. 20, 1959, the Hamilton Branch held their monthly meeting at the Fischer Hotel, York St., Hamilton, Ontario, with an attendance of 54. **Al Lee** introduced **F. Voege,** of the Ontario Water Resources Commission, who spoke on "The Problem of Industrial Waste Disposal". After an interesting talk which demonstrated the limits within which we in the painting and platings fields must operate, he answered questions during a vigorous question and answer period and was thanked by **Earl K. Cranfield.**

It was announced that next month we were to hear from **Mr. W. Orlich** of Tumbling Sales and Service on "Modern Tumbling Methods."

Earl K. Cranfield
Reporting Secretary

INDIANAPOLIS
Kerr Describes Anodizing of Aluminum

The second meeting of the Branch at the new meeting place, The Construction League, 1456 N. Delaware, was very much enjoyed by 35 members and guests on Dec. 1. It was agreed that the food was superb.

Five new members were voted into the society. A hearty welcome was extended to one transferred member from the Hartford Branch.

Roman Bender moved that the secretary be sent to the Interim Meeting in February at Philadelphia with expenses paid. This was seconded by **Quentin Shockley** and passed.

Lapel pins will be ordered by the treasurer for any member who desires one and a reminder will be sent with the statements.

Mr. Shockley reported on the Tri-State activities and future plans. As the general fund of the Tri-State is slowly decreasing, the bylaws are to be revised to remedy this condition. The next meeting is in Cincinnati, tentative plans are to have an educational session in the morning with two technical papers and three papers to be given later in the afternoon. A $3.00 registration fee will be charged for those who wish to attend the educational sessions only.

Beyond any doubt the program for this meeting proved to be about best we have had in many a year. **Mark Trook,** librarian, introduced **Jack Kerr** of Reynolds Metals Co. who talked on "Finishing of Aluminum". Mr. Kerr was a very humorous and clever speaker but never failed to bring one back to the subject.

He stressed five points necessary for anodizing: (1) rack parts properly, (2) parts must be thoroughly cleaned, (3) use proper alloy when going into set-up, (4) anodizing tank must be maintained at a constant and uniform temperature and (5) sealing tank must be clean and hot, above 208F and use demineralized distilled water. Mr. Kerr had a complete miniature set-up on hand and demonstrated how to anodize. He displayed many samples of the finish. After many good laughs and much good information about anodizing, it was agreed that this was truly a good meeting.

Edna Rohrabaugh

KANSAS CITY
Coated Abrasives Presented by Taylor and Brennan

November's program of the Kansas City Branch was entitled "Coated Abrasives," and was furnished through the courtesy of the Behr-Manning Corp. **B. L. Brennan,** field engineer of Kansas City, and **B. S. Taylor,** divisional manager of St. Louis, of Behr-Manning presented two very interesting color/sound films which pictured the various uses and specialized applications of coated abrasives in metal finishing.

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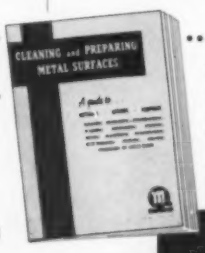

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Prior to the technical part of the program, routine matters of business were taken care of in the regular meeting and in the executive board session. Programs and information about the Aerospace symposium to be held in Fort Worth were distributed.

A total of 15 members and guests, including four from out of the city were in attendance.

Robert L. Garrett
Secretary

KANSAS CITY

National President's Visit a Milestone in Branch History

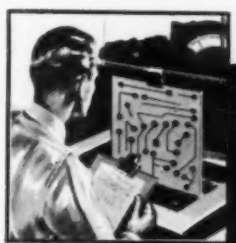
December 10, 1959 is listed as an outstanding date in the history of the Kansas City Branch. This was the occasion of the first invited visit of a National Officer since the Branch received its Charter in 1952. On this date, the thirty members present heard first hand about the national structure of the Society from its colorful president, **Ralph D. Wysong.** To many of our members who have never attended a National Meeting, this was the closest the Supreme Society has come to Branch activities.

The evening began with a social hour at 6:00 p.m. in the Topic Room of Regan's Restaurant. The refreshments were compliments of **R. E. Loupee,** Davies Supply Co. At 7:00 p.m., John Regan served his outstanding entree of baked ham and cherry sauce with all the trimmings. There were even a few extra portions for those who excel in this activity. After a brief intermission, the Branch president, **C. Scott Sterrett,** called the meeting to order at 8:20 p.m. Minutes of the previous meeting and the treasurer's report were read and approved.

NATIONAL PRESIDENT ADDRESSES RECORD KANSAS CITY BRANCH MEETING.
The head table (above) at the dinner meeting of the Kansas City Branch addressed by National President Ralph D. Wysong. Left to right, R. C. Garland, Branch treasurer; Warren Eliot, Branch first vice president; R. D. Wysong; C. Scott Sterrett, Branch president; W. E. Des Jardins, Branch librarian; R. L. Garrett, Branch secretary.

A report on the Aerospace Symposium held the two days previously in Fort Worth was given by Scott Sterrett and **Bill Harding,** both of whom were in attendance. Mr. Harding gave a brief review of the papers presented and Scott Sterrett reported on the discussion concerning the formation of the Southwest Regional. Considerable interest in this proposal was shown by the membership, and after discussion it was regularly moved, seconded and carried to become a participating Member Branch in the informal organization of six Branches with control authority vested in the Branch Presidents.

The meeting was then turned over to the librarian, **William DesJardins** who announced the speakers and subjects for the next four monthly meetings: January 13— **Henry Brown** of Udylite; February 13—



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Ezra Blount of "Products Finishing" (Ladies Night); March 10—**Morton Gilbert** of Stokes Vacuum Metalizing; April 14—**Arnold Parlich** of Cleveland Supply Company.

Mr. DesJardins then presented National President Ralph D. Wysong of Studebaker-Packard at South Bend, Indiana. "Duke" proceeded to outline the structure and organization of the AES in as complete and concise a manner as is possible. As was previously mentioned, this was most informative to many members who have not been in a position to observe this in action at the National Conventions. Such things as the Research Program, Sustaining Memberships, The National Officers and Executive Board, the workings of the National Executive Secretary's Office, and the Supreme Society's Awards became very real to the attentive members present.

Duke gave his approving comment on the action of this Branch in the matter of the Regional and dwelt at length on the workings of the other Regionals already in operation. He concluded his presentation by answering and discussing many questions which his talk had drawn from the listeners. When he had finished, he received the thanks of the president in behalf of the Branch and the meeting was adjourned at 10:15 p.m.

Robert L. Garrett
Secretary

LOS ANGELES

Panel on Customer-Processor Cooperation

The Nov. 11 meeting was called by President George Hetz. **Bill Lidke** reported for the Handbook Committee and requested more advertisers. **George Hetz** reported for the 1960 Convention Committee—everything progressing satisfactorily.

Oscar Grisat reported two new sustaining members: Peterson Plating & Manufacturing and Burton Silver Plating.

The meeting was turned over to Librarian **Marge Farmer,** who introduced the speakers on the panel for the evening; their subject was "Customer-Processor Cooperation". The panel consisted of **Whity Lunt, Bob Singrin, Bob Martin, Earl Arnold** and **Irv Greenwald.**

H. K. Hunt
Secretary

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LOS ANGELES

Motion Picture Presented; Eight New Members Initiated

The Dec. 9 business meeting called to order by President **George Hetz** at 8:25 p.m.

Second Vice President **Emmett Babcock** reported for **Frank Virgil** on new members. He presented eight men who were duly initiated into the branch.

President Hetz reminded the members of the approaching election in March and announced a Nominating Committee would be appointed.

President Hetz, in the absence of **Marjorie Farmer,** introduced **John Feeney,** who presented the evening program of very interesting movies.

H. K. Hunt
Secretary

MILWAUKEE

Andrus Talks on Aluminum Finishes

The 503rd regular meeting of the Milwaukee Branch on Dec. 4 was called to order by President **Cy Tatarczynski.**

Five men were accepted into the Branch. **Art Svoboda** reported on Racine Nite and stated that plans are in the making for a Racine Nite next year and a committee had been formed.

Phil Ritzenthaler reported on the meeting of the GMTS he attended and suggested the matter of affiliation be brought to the attention of the Board of Managers at their next meeting.

Henry Bornitzke reported that all who attended the Rockford voiced praise of the manner in which this meeting was planned and conducted. He also commented on the splendid participation of members in the exhibits. **Ted Sobczynski** reported on the organic sessions and he, along with Mr. Bornitzke, commented on the possibility of using the "work shop" idea in monthly meetings.

A card poll of the members had been taken at the educational sessions at the Annual Meeting and the results were announced. They are to be recommended to the board of managers to be used as a guide in the planning of the next Annual Meeting.

After the chair extended Season's Greetings to the members, the meeting was turned over to **Frank Marshall** to introduce **Joseph Andrus,** who presented a talk entitled, "Decorative Finishes for Aluminum".

Frederick F. Padgett
Secretary-Treasurer

MOHAWK VALLEY

Barrett Discusses Sulfamate Nickel

The meeting at Thompson's Hotel, Yorkville, N. Y. on Oct. 22, 1959 was opened by President **Jack Bension,** with 30 in attendance. **Robert Stewart** expressed thanks to **Merle Ihrie** for arranging the Scintilla Division of Bendix, Sidney, N. Y. tour. The secretary was instructed to send a letter of thanks to Carlton Dwight of Bendix for a most interesting plant tour.

Mr. Bension reminded the members that many are in arrears in their yearly dues and the per capita tax will have to be sent in without them.

Merle Ihrie noted the Regional Meeting will be April 29 at Elmira. Ted Duvall reported that refreshments for the evening were through the generosity of **Walt Sacket** of Oakite Products Co.

Mr. Duvall introduced **Richard C. Barrett** who spoke on Sulfamate Nickel.

Many applications have been found within the last five years for this bath. Among these are high temperature uses, missiles, etc. Temperatures up to 1750F are common. Brazing and soldering is successfully done on this nickel. It is stress free and pore free with heavy deposits, and is used mostly as nondecorative plate. Fatigue failure is negligible. It is especially good for electrical contacts and very useful for printed circuits. It offsets stress of rhodium on nickel. Sulfamate Nickel has wide application in electroforming, current densities of 75 amp/sq ft. Very ductile, it is used extensively for phonograph masters. It has wide application for hard nickel and build-up.

Henry J. Crouse
Secretary

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MOHAWK VALLEY

Murray Speaks on Plating on Aluminum

The Nov. 12 meeting at the Golden Tea Pot Inn, New Hartford, N. Y. was opened by president **Jack Bension,** who welcomed the 25 members and guests.

A letter from National Office was read pertaining to the 1960 convention.

The secretary presented an application for membership. A motion was made by Mr. Bension and seconded by **C. A. Bridgett** to accept the application. The motion was carried.

R. A. Stewart reported the Christmas Party will be Dec. 11 at Twin Ponds Country Club and asked full support to make it an enjoyable affair.

Librarian **Ted Duvall** introduced **William K. Murray** who spoke on Plating on Aluminum.

Mr. Murray stated that aluminum is easily available and many are switching to this metal. There is continuing research going on to find additional applications. Besides being light, it is cheaper when considering pounds vs volume. It is easier to work, buff, polish, etc.

He stated there are many corrosive conditions where anodizing is superior to plating. There are two processes to prepare for plating, 1) etch, 2) non-etch. It is customary to preclean with vapor or emulsion before etching to obtain a uniform etch.

A smut is formed on many alloys and can be removed by an acid dip of nitric acid, or if silicon is present nitric and hydrofluoric acids.

There are also some good proprietary fluoride salts available. One of the most common dips used to prepare for plating is the zincate dip, and a thin coating is desirable. A double dip is sometimes used (zincate, nitric, zincate) if the surface is non-uniform from cold working.

With castings rejects are often caused by porosity, voids, gas and non-metallic inclusions.

After a vote of thanks to Mr. Murray, the meeting was adjourned for refreshments through the courtesy of **Harold Harper** of Austin Fletcher Company.

Henry J. Crouse
Secretary

NEW YORK

Tilton Speaks on Plating and Anodizing Racks

Librarian **Martin Pollack** conducted a question and answer period before the Nov. 27 meeting started. All members present, judging by interest shown to both questions and answers, proved this session a success. Members are invited to bring their shop problems and members in attendance will help solve them.

The regular meeting was called to order by President **Joseph Rembecki.**

Montreal Branch informed that they are going to charter a plane, leaving New York for the AES convention at Los Angeles.

Librarian Pollack introduced **Mr. Herb Tilton,** sales engineer for National Rack. With the aid of slides Mr. Tilton explained various methods and machines used in the construction of plating and anodizing racks. He covered some of the considerations to be taken before actual construction, such as current capacity, need for spacing between pieces, efficiency of solutions to be used and need for built-in anodes on certain racks. He also covered the various materials used in construction as well as the need for clamps on the hooks of racks used with agitation.

Mr. Tilton, a member of the Newark Branch, received a rising vote of thanks.

Fred Saras
Recording Secretary

NEW YORK

Strow, Innes, Nobel and Schore on Copper Plating

The usual question period preceding the Dec. 18 meeting at the Hotel Statler was cancelled to allow more time to our "Symposium on Copper Plating," speakers.

President **Joseph Rembecki** called the meeting to order at 8:30 p.m.

Motion made and carried that five applications for membership follow regular course.

Motion made and carried that three new members, recommended by the board of managers, be accepted. The new members were duly sworn in by President Rembecki.

Milton Nadel informed members to notify him of any change in address or

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business connection so they may be correct for publication on our Banquet Journal.

Librarian **Martin Pollack** conducted the "Symposium on Copper Plating." The first speaker of the evening was **Henry Strow** of the True Brite Corp. who thoroughly covered "History of Bright Copper Plating." **William P. Innes** of the McDermid Corporation covered "Impurities in Bright Copper Solution." Mr. Innes went through all possible impurities found in bright copper solutions and outlined the methods for their removal from the bath. **Fred Nobel** of Lea Ronal Co. spoke on "Modern Developments in Bright Copper Plating." Mr. Nobel a member of our Branch covered the latest developments on bright copper. Martin called on **George Schore** who gave an impromptu talk on acid copper plating to complete our "Symposium on Bright Copper Plating." The members who filled every seat available, showed their appreciation to the speakers by giving them a rising vote of thanks.

Fred Saras
Recording Secretary

SAGINAW VALLEY
Buff Design and Techniques Presented by Sax

The November dinner meeting was held at Zhender's Hotel in Frankenmuth, Michigan, Wednesday, Nov. 11. Fifty-nine members and guests were present.

The speaker for the evening was **Stanley Sax,** vice president of the American Buff Co. Mr. Sax's talk was a comprehensive description of current techniques used in the manufacture of the buffs for the metal finishing industry. Several slides were used to illustrate different buff designs.

Following the talk a movie, "Exhibition Shooting" was shown by the entertainment chairman, **Jim Read.**

Harrison F. Hooker
Recording Secretary

ST. LOUIS
Burkhard Talks on Metal Cleaning

The Dec. 9 meeting of the St. Louis Branch was held at the York Hotel with 26 members and guests present for dinner. There were 38 present when President **William Piel** called the business meeting to order. This particular meeting was publicized in both daily newspapers, by radio and the members were telephoned in order to remind them of the meeting and to stimulate attendance. Two guests stated they attended as a result of reading the newspaper announcement.

There was no new or old business to be brought before the group and the committee reports were short. The meeting was turned over to our librarian who introduced **P. N. (Butch) Burkard,** manager of the Industrial, Railroad and Aircraft Departments of the J. B. Ford Division of Wyandotte Chemical Corp. Mr. Burkard talked on Recent Developments in Metal Cleaning. He covered synthetic detergents, organic acids and alkaline salts and their functions in metal cleaning. He was slightly handicapped by not being able to show his slides since the projector which had been arranged for did not show up, but he did a very excellent job covering the subject without the slides.

Ward Kelly
Secretary

WATERBURY
Gabel Discusses Zinc Baths

The Waterbury Branch had its December meeting at the Hotel Elton on Dec. 10, 1959. The Branch voted in two new members at the meeting. **Ed Garland** reported that the committee had contacted the Library regarding the placing of technical books and that we are about to start purchasing the books. The entertainment committee reported that the February Social will be held at the Waterbury Country Club on Saturday, Feb. 6. Bylaws have been drafted for the Branch and copies of the draft have been distributed for the comments of the members.

Leroy Gabel of Allied Research Products, Inc. talked on "Zinc Electroplating Baths and Related Chromates." He presented data indicating the effect on efficiency of bath composition. He showed the effects of high and low cyanide, high and low metal, high and low caustic and ratio on the operating characteristics of zinc solutions. By interpretation of the data a zinc solution can be formulated which will give the desired operating characteristics.

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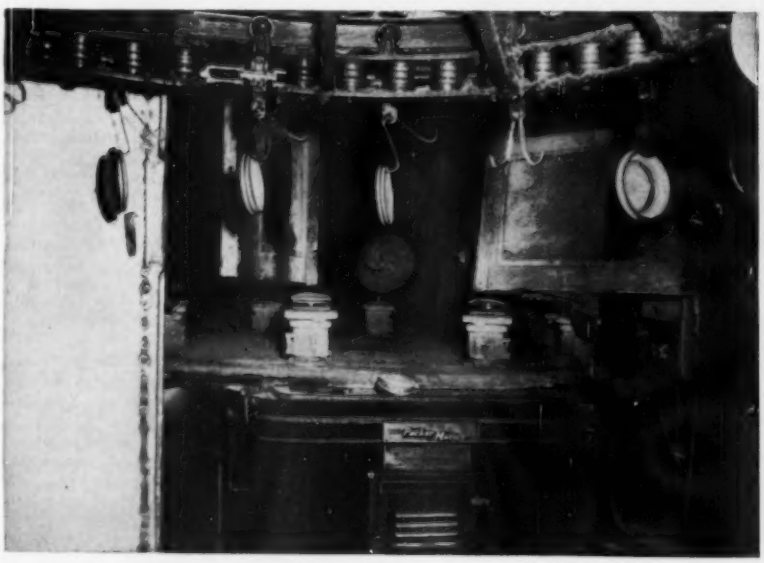

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Boston: W. V. Bigos

Chicago: R. G. Nolte, H. C. Weist, D. Russell, H. W. McClure, T. W. Reinewald, A. R. Simmons

Cleveland: J. F. Revilock, P. R. Zwaryez

Dayton: D. H. Huff, M. Harris H. H. Hormann

Detroit: M. Ambrozy, D. Jones, G. Wohlfeld

Grand Rapids: G. J. Ambrose

Indianapolis: W. W. O'Brien, D. J. Branch, C. Overholt, D. W. Royalty, R. B. Adams

Kansas City: R. W. Davis, C. L. Kreeger

Louisville: L. T. Endicott

Miami: W. E. Hill, W. H. Slack, L. A. Marinello

Milwaukee: W. Bindrim, O. P. Catlin

Newark: C. Allegri, P. Gryczko, R. Hock, S. Lucco, R. Pizzarelli, J. G. Romano

Philadelphia: G. E. Glover

Pittsburgh: F. J. Fitzpatrick, F. E. Stouffer

Providence-Attleboro: F. C. Strong

Rochester: W. J. Kushner

Toledo: J. Robie, R. J. Meyers, W. H. Barney

Western Ontario: J. F. Komon, A. R. Hurst

Member-at-Large: L. Harrington, R. G. Maling, H. R. Tyler, L. A. G. Herrera

REINSTATEMENTS

Boston: E. E. Rostedt, P. A. Morin, R. A. Peak, L. J. Van Vorse

Chicago: A. C. Zameit

Lancaster: G. Lefevre

Mohawk Valley: R. Bantham, R. Howard

Philadelphia: T. J. Grindler Jr., P. J. Lestician

St. Louis: W. Sullivan, W. Keck

Toledo: G. R. Weaks

TRANSFERS

Blue Ridge: D. Taylor from Cincinnati, G. Lefevre from Lancaster

Chicago: T. Henner from Grand Rapids

Cleveland: E. F. Foley Jr. from New Haven

Dayton: C. Kiser to Louisville, F. H. Dayton to Milwaukee

Detroit: W. H. Kreage from Member-at-Large, L. E. Johnson to New York

Grand Rapids: T. Henner to Chicago

Hartford: J. W. Carr to Member-at-Large

Indianapolis: E. F. Taylor

Lancaster: G. Lefevre to Blue Ridge

Milwaukee: F. H. Dayton from Dayton, W. B. Gertz from Detroit, J. I. Vlosak from Detroit

Newark: A. Klin to Seattle-Puget Sound

RESIGNATIONS

British Columbia: K. M. Bain, J. P. Grist

Buffalo: R. L. Wasson, R. R. Brenan

Cleveland: W. W. Palmquist, A. Pope, W. M. Radtke

Dayton: J. C. Emminger, R. G. Counselman

Indianapolis: R. G. Van Houten

Newark: R. H. Goodman, H. Phelps

SUSPENSIONS

Boston: J. Cooper, J. Prudden, E. N. Rollfs, E. E. Rostedt, L. J. VanVorse, R. C. Waterhouse, B. C. Wiggin, G. C. Williams, P. E. Bloom, F. B. Clark, J. J. Cloonan Jr., N. J. Cormeau, W. P. Gornyn, A. C. Durkin, G. Fairbairn, W. P. Galvin, J. Gottlieb, F. C. Koury, M. Kraff, R. C. Matthews, R. S. Morin, M. Morse, T. P. Norton, R. A. Peak, S. Polcari, J. P. Farris, L. H. Gaffen, A. Grannse, J. P. Raleigh, J. B. Warburg, W. P. Cobb, D. C. Fraser, J. A. Poole

British Columbia: B. V. Lyhne, S. W. Nerada, F. Robinson

Buffalo: F. Roiler, M. Stachura, R. Ludwig, T. W. Brandes

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Grand Rapids: L. E. Colg, R. E. Earl, L. McNott, R. Nichols, C. F. Williams

Indianapolis: J. Lazar, R. W. Priddis, L. E. Worrell

Milwaukee: D. Booth, E. Brown, A. Freeman, C. Hill, R. Honkamp, C. Hamilton, G. Krause, A. Lehmann, J. Monday, F. Musch, G. McCormick, D. Pottorff, E. Rinehart, T. Skuba, J. Vogel, H. Wrasse, E. Wentorf, J. Weber, J. Wall

Mississippi Valley: A. F. Hansen, D. E. Hintz, G. Mason, R. Stuart

Newark: G. Aggar, R. Roberts

Rochester: D. Messinger

Southeastern: F. M. Suchke

Springfield: M. J. Murray, M. P. Roske, W. Seidel

Wichita Kansas: L. Lawless, J. Pirrone

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FUTURE MEETINGS

AMERICAN ELECTROPLATERS' SOCIETY

February 6, 1960—**New York Branch,** Annual Educational Session and Dinner-Dance, Statler-Hilton Hotel, New York, N. Y.

February 18, 1960—**Research Committee Meeting,** Ben Franklin Hotel, Philadelphia, Pa.

February 19-20, 1960—**Seventh Interim Meeting,** Philadelphia Host Branch, and Golden Anniversary Educational Meeting and Banquet of Philadelphia Branch, Ben Franklin Hotel, Philadelphia, Pa.

February 19 & 21, 1960—**Executive Board Meeting,** Ben Franklin Hotel, Philadelphia, Pa.

February 20, 1960—**AES Membership Committee Breakfast Meeting,** Ben Franklin Hotel, Philadelphia, Pa. (7:30 a.m.)

March 5, 1960—**Dayton Branch,** 14th Annual Educational Session and Banquet, Hotel Biltmore, Dayton, Ohio.

April 8-9, 1960—**Executive Board Meeting,** National Headquarters, Newark, N. J.

April 9, 1960—**Baltimore-Washington Branch,** Annual Banquet and Dance, Presentation of the "Order of the Pot," Park Plaza Hotel, Baltimore, Maryland.

April 23, 1960—**Sixth Tri-State Regional Meeting,** Cincinnati Host Branch, Sheraton-Gibson Hotel, Cincinnati, Ohio.

April 23, 1960—**Twenty-First Annual New England Regional Meeting,** Bridgeport Host Branch, Hotel Statler, Hartford, Conn.

April 29-30, 1960—**Sixth Empire State Regional,** Southern Tier Host Branch, Mark Twain Hotel, Elmira, N. Y.

April 30, 1960—**Milwaukee Branch,** Annual Meeting and Banquet, Schroeder Hotel, Milwaukee, Wisc.

July 24-28, 1960—**47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif.

July 24, 1960—**Executive Board Meeting,** Statler Hotel, Los Angeles, California.

September 17, 1960—**Boston Branch 24th Annual Educational Meeting and Banquet,** Hotel Statler, Boston, Mass.

February 3-4, 1961—**Third Annual Dixie Regional Technical Session,** Hotel Roanoke, Roanoke, Virginia. Blue Ridge Host Branch.

June 18-23, 1961—**48th AES Annual Convention,** Hotel Statler, Boston, Mass.

FUTURE MEETINGS

June 25-28, **1962—49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council.

June 24-27, **1963—50th AES Annual Convention,** Ambassador Hotel, Atlantic City. N. J. Sponsorship Newark Branch.

June 21-25, **1964—51st AES Annual Convention,** St. Louis, Missouri

July, **1965—52nd AES Annual Convention,** Statler Hotel, New York, N. Y.

INTERSOCIETY

February 19, **1960—Joint Evening Meeting,** Board of Trustees, Metal Finishing Suppliers' Association (MFSA) and Executive Board, American Electroplaters' Society, Inc. (AES), Ben Franklin Hotel, Philadelphia, Pa.

March 9-11, **1960—Instrument Society of America,** Temperature Measurement Symposium, Deshler-Hilton Hotel, Columbus, Ohio.

March 14-18, **1960—National Association of Corrosion Engineers,** 16th Annual Conference and 1960 Corrosion Show, Dallas, Texas.

April 21-28, **1960—American Society of Tool Engineers,** Tool Show, Detroit Artillery Armory, Detroit, Michigan.

May 1-5, **1960—The Electrochemical Society,** Spring Meeting, LaSalle Hotel, Chicago, Ill.

May 9-13, **1960—American Society for Metals,** 2nd Southwestern Metal Exposition and Congress, State Fair Park, Automobile Building, Dallas, Texas

May 14, **1960—Masters' Electro-Plating Association,** 42nd Annual Banquet, The Plaza, New York, N. Y.

June 26-July 1, **1960—American Society for Testing Materials,** 63rd Annual Meeting (with Apparatus Exhibit), Chalfonte-Haddon Hall, Atlantic City, N. J.

July 22-24, **1960—National Association of Metal Finishers,** 5th Annual Convention, Hotel Statler, Los Angeles, California.

October 9-13, **1960—The Electrochemical Society,** Fall Meeting, Shamrock Hotel, Houston, Texas.

October 17-21, **1960—American Society for Metals,** 42nd National Metal Exposition and Congress, Trade and Convention Center, Philadelphia, Pa.

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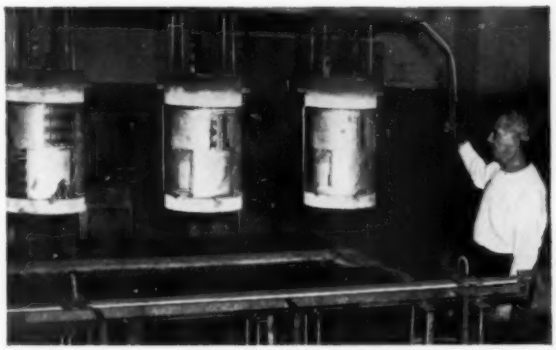

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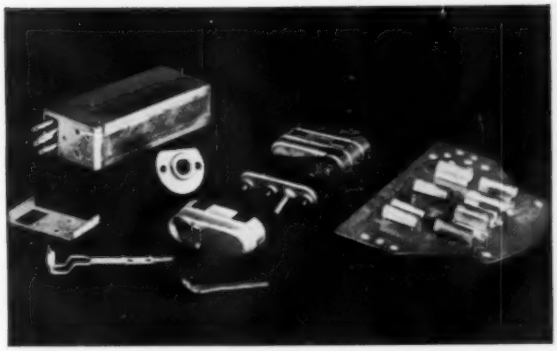

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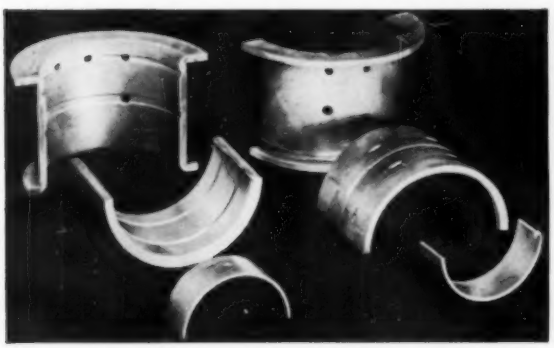

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